Labor Market Effect Analysis

Energy Transition and Jobs in the Western Balkans

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Content

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Disclaimer:

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Executive summary

The electricity mix of Western Balkan (WB) countries highly depends on conventional power sources—fossil fuels (Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia) and hydropower (Albania). Decarbonising the electricity mix is necessary to achieve commitments under the Paris Agreement and the Energy Community Treaty. The integration of renewable energy sources (RES) contributes to the diversification of the electricity mix, a precondition for improved energy security, decreased vulnerability to volatile import prices and most importantly better health, social and environmental conditions for WB citizens.

The increased use of renewables is closely linked with structural changes in the electricity market, which is becoming decentralised, digitalised, and flexible. **New emerging RE technologies have the potential to create jobs**. Based on formally adopted RES targets in each WB country[1], the conservative estimate is that in 2030, there will be 25,600 jobs in the renewable electricity sector in WB, 73% of which (almost 18,700 jobs) will be new.

The **RE-based electricity sector is technically different from fossil-fuel-based systems.** Deployment of intermittent renewables (wind and sun) requires a flexible system, the use of demand-response, improvements in the grid, and the development of storage capacities. More market participants exist in the RE-based power sector than in the traditional power market. New digital technologies to monitor and manage electricity flows in real-time and balance supply and demand, build and manage energy storages, manage decentralized power generation, upgrade transmission infrastructure, grid decarbonization and expansion to support electrification **require a number of new occupations and a large number of employees with new skills.**

Phasing out fossil fuels is linked with job losses. The use of RES creates new jobs that require a different skill set. The number of RES jobs that can be created by 2030 corresponds to 40% of current jobs in coal-based TPPs. This indicates that the social dimension of energy transition in the Western Balkan can be managed if reforms are developed under a cross-sectorial just energy transition framework to minimise negative effects and maximise positive effects of renewable-based energy transition.

The relevant reforms go beyond the power sector as the socio-economic context is relevant for investments, innovations and labour market developments, especially in strengthening VET's role in this process. The WB countries face a shrinking labor force caused by negative demographic trends and emigration. Labour markets also have low activity rates, youth unemployment and a significant gender gap. There are lower female employment rates, higher female unemployment rates, and fewer female graduates from a science or technology discipline. Attracting women to RES-related education and training can help bridge the skills gap. Demographic structure and its change also determine electricity demand.

[1] Based on each WB country adopted NECP and other documents under energy legal frameworks.

In addition to demographic factors, the quality of institutions and legal framework are considered. Laws and institutions create enabling conditions or barriers for the decarbonisation of the power sector. **The lack of a domestic legally binding framework and timetable for decarbonisation are identified as barriers to faster penetration of RES**. In addition, the quality of institutions in terms of good governance in the Western Balkans is more likely to create barriers than to foster the transition. Thus, technical support and capacity-building activities are necessary. This goes beyond institutions necessary for RES deployment and includes all electricity market players (DSOs, TSOs, regulators, competition agencies, market operators, suppliers), Vocational Education and Training (VET) institutions, universities and the judiciary as they are relevant for investment climate, market design and labour market development.

Based on the findings of this study, the following recommendations for policymakers are formulated:

- Formally adopt climate neutrality goals by 2050 and develop action plans for the phase-out of fossil TPPs, supported by just transition frameworks.
- Improve the regulatory framework that enables the decarbonisation of energy systems
- Improve the business environment and investment climate to attract RE projects in the region.
- Develop financial instruments for restructuring (including social protection of workers in coal-mine regions)
- Encourage inclusion in the formal labour market
- Continue to develop general public awareness about the need to limit emissions, decarbonise power sector and social perspective of energy transition.
- Establish cross-sector cooperation between energy and education section to support the anticipation of skills gaps in the energy workforce and enable competence reinforcement taking into consideration new emerging RE-based technologies.

1. Effects of the Energy Transition on Job Creation, Job Loss, and Gender Gaps

This study identified many concerns about the negative effects of the energy transition. These include potential job losses, challenges in creating new jobs in renewable technologies, and the adverse impact that the decommissioning of traditional thermal power plants (TTPs) may have on the stability of the national electricity network and supply, as well as job loss.

The data collected show that approximately 138,000 jobs are associated with coal-related sectors in the WB countries, with *90,000 jobs in the mining industry and 49,000 in coal-based thermal power plants (TPPs*). If coal is phased out, it is estimated that the following percentage of the total

workforce may be affected: 0.4% in Montenegro, 0.5% in North Macedonia, 0.6% in Serbia, 1.3% in Bosnia and Herzegovina, and 1.4% in Kosovo.[2] [3]

Furthermore, the study results indicate that investing in the renewable energy sector can support Western Balkans countries in generating new jobs, especially in areas or vulnerable regions with high unemployment rate, thus contributing to economic growth and increasing employment rates.

The integration of renewable-based energy technologies offers a valuable opportunity to tackle gender gaps in employment. Research shows that renewable energy projects can create a variety of job opportunities, ranging from technical roles in engineering and maintenance to positions in project management. By actively promoting gender equality in hiring and training within the renewable energy sector, Western Balkan countries can reduce the unemployment gender gap and empower women economically. The *figure 1* shows the estimated job generation in the renewable energy sector until 2030 in the Western Balkan region.

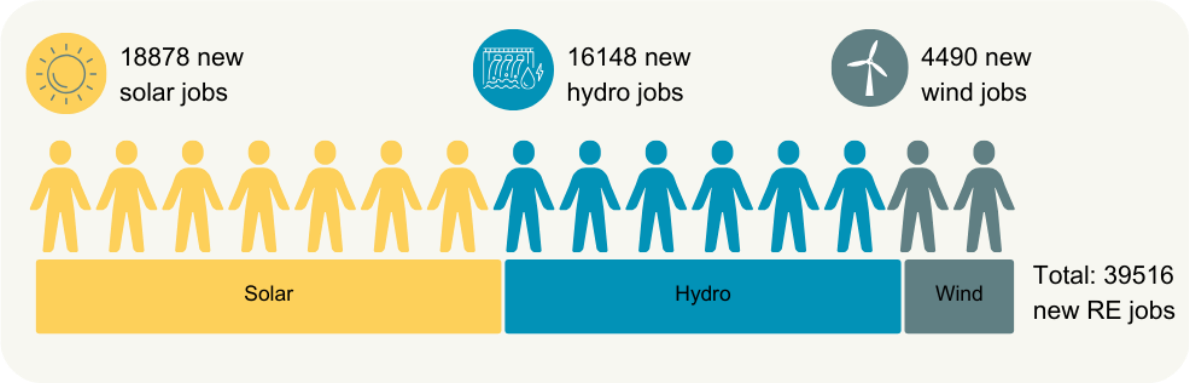


Figure 1: *Estimated job creation in the renewable energy sector until 2030*

These estimates are based on calculations conducted under the frame of this study. The strongest job creation will occur in solar energy generation, with an expected 18,878 jobs to be created across the WB countries.

The estimation of direct and in-direct jobs indicate that the total number of new jobs created in the six Western Balkan countries exceeds 55,000. Projections show that solar energy production will account for most of these jobs, generating over 76% (approximately 42,391) of all direct and indirect jobs in the renewable energy sector.

2. Missing Workforce Skills for Energy Sector Decarbonisation

This study found that growth in the renewable energy sector will change the demand for jobs, moving away from traditional energy roles toward new positions that require advanced technical and digital skills. Skills such as installing, maintaining, and managing renewable energy

[2] Ruiz Castello, P., Medarac, H., Somers, J. and Mandras, G., Recent trends in coal and peat regions in the Western Balkans and Ukraine, EUR 30837 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41929-7, doi:10.2760/81752, JRC126154.
[3] For summarised information see also BiEPAG (2023).

technologies and a strong understanding of energy efficiency are becoming increasingly important.

As shown by the projections performed under this study and confirmed by the interviewed key informants (*representatives of different key education and energy institutions*), **workers with skills in the renewable energy sector will be increasingly in demand in the labour markets**. The demand for solar-based energy production is expected to rise significantly, and Bosnia and Herzegovina and Serbia will need to address the challenge of educating approximately 10,000 workers. These individuals will require training in the installation and maintenance of solar energy production equipment and in the management of solar energy technologies.

Some professions that will be in demand in solar energy production include *solar engineers, solar system designers, solar project managers, solar panel installers, and solar service technicians*. A similar range of careers will also be available in wind turbine energy production systems.

According to the KIs, the easiest way to address a skill mismatch between the skills of the available workforce and available jobs is for the companies to provide on-the-job training and upskill their existing staff. However, going further and with the advancement of the energy transition, companies will also need new staff. That is the part where the formal education system should step in.

Data collected reveals that current processes for workforce adjustments in the renewable energy sector are slow in responding to expected demands. Although at the policy levels, there is certain progress in all Western Balkan (WB) countries, on the ground the decarbonization of the energy sector is still at the initial phase in terms of investments and other commitments. Most of the activities implemented so far have focused primarily on public discourse about the critical need for energy transition. There have been shortcomings in terms of cross-sectorial cooperation, which has led to a lack of urgency regarding the necessary changes in the education system and workforce upskilling needed to support the energy transition in the Western Balkan countries.

There is limited action and coordination about the shortage of workers with specific skills in the renewable energy sector. However, there is significant concern regarding the overall lack of a qualified workforce in the labour markets of WB countries.

First, we develop occupation standards with the companies, which such a technician must know. Employers tell us what knowledge and skills they need, and we do a standard where we define what needs to be taught to achieve that; after that, we develop the educational plan and program that the Ministry of Education must approve. Then we can start to enrol students next year. But we want this process to be not only formal education, we also need to work on informal, for a shorter period that must be approved by the Center for Adult Education.

Key Informant Interview

There are differing opinions about the necessity of establishing specific qualification standards and training programs for workers in the renewable energy sector, such as solar panel assemblers. However, the processes involved in developing qualification standards, educational plans, programs, and their approvals are often subject to bureaucracy. They can take up to two years before the first student is enrolled.

In addition, certain interviewed education stakeholders stated that they are currently developing curricula for various professions in the renewable energy sector. These include renewable energy engineers, maintenance and installation technicians, energy analysts, and sustainable development consultants. They also emphasise the need to address workforce development in the energy efficiency and occupations related to digitalisation. This is especially important since companies must undergo both processes.

Some interviewed stakeholders believe that existing qualifications, like those of an electrical or energy system technician, are sufficient, provided these technicians receive some short additional training. For example, the energy sector technicians would need to upgrade their skills to keep up with evolving technologies and work environments. This entails overcoming challenges related to installing, commissioning, and maintaining renewable energy structures and equipment. The working conditions demand strict compliance with health and safety regulations and protocols, as technicians may need to lift heavy equipment, work in remote locations, operate at heights and endure extreme weather conditions. Also, In the future, renewable energy technicians, who currently need experience and skills in one or two specific forms of renewable energy, will need to expand their roles. They must focus on developing renewable technology and addressing the increasing supply and demand for these energy sources.

According to interviews with grid operators, these companies are not perceived as attractive employers, particularly for high-quality engineering experts. As a result, they need to invest significantly more effort in improving job quality to retain their current workforce and attract the new talent necessary to meet the challenges posed by the energy transition. According to KIs, grid operators must develop their capacities and internal competencies to face challenges and act as agents of change in the energy systems of the WB countries.

3. Matching the supply of energy sector professionals with the evolving demand in renewable energy and energy efficiency sectors

All countries' labour markets face worker shortages and a lack of qualified individuals in the renewable energy and energy efficiency sectors. Key issues include low labour market participation rates, particularly in certain Western Balkan countries like Bosnia and Herzegovina, and a mismatch between the skills and knowledge of the available workforce and the requirements of jobs. Also, the interviewed key informants (KIs) explained that the education system fails to prepare students for the workforce, leading to a mismatch between the skills of workers and the available jobs. Despite efforts to address the issue by implementing a dual

education system, interest remains low in large-scale adoption, even though formal preconditions exist.

To address these labour shortages, it is essential to increase market participation among youth—especially those not in education, employment, or training (NEET)—women, older workers, discouraged workers, and individuals in the informal sector. Enhancing their attachment to the labour market will require a combination of incentives for companies, support for these vulnerable groups, and robust retraining and upskilling opportunities.

In the long run, adjustments in the formal education system—particularly in VET and tertiary education—should align with evolving demand. It is the responsibility of the Ministries of Education, along with other qualification agencies and educational institutions, the private sector (*energy)*, and various stakeholders, to engage in discussions and reach agreements on developing new qualifications. To achieve that, a permanent working group of representatives from the Ministry of Education, the Ministry of Energy, the Chamber of Commerce, VET institutions, adult training institutions, and other stakeholders will be necessary to expedite information exchange and embed these topics into the education system. Their mandate should explore how to implement open curricula and integrate the green agenda and renewable energy throughout the education system. However, to meet energy transition objectives by 2030, a high-capacity and flexible adult education system will be necessary.

Cross-sector cooperation should enhance the alignment of various strategies aimed at developing systematic solutions. It should facilitate the identification of skills gaps, promote adequate training, and address the technical, economic, and societal challenges that hinder the decarbonization of the power sector.

More specifically development of systemic solutions would require:

- Preparing an analytical basis that includes assessment of financing/investment opportunities, qualitative and quantitative impact assessments of the investments in infrastructure, education, institutional capacity development, and business-environment, on the labour market for energy sector.
- Support the preparation of business decarbonisation strategies, including investment plans and social & labour plans
- Identify the necessary future skills of workers and refer them to education, upskilling and retraining
- The development of training and educational programs aligned with the needs of the labour market
- Informing workers about the need to engage in lifelong learning programs and strengthen competencies for renewable-based energy technologies.

In addition to the above, based on the findings of this study, creation of roadmap defining a set of actions to support the Western Balkan countries contributes to a more flexible education system which respond to evolving needs of energy labor market. This system should address the skills gaps in the renewable energy sector and support the decarbonization of the energy sector as well as the overall energy transition.

The key recommendations focus on strengthening educational institutions, increasing access to lifelong learning opportunities, and addressing workforce gaps in critical sectors like renewable energy.

The proposed initial set of actions:

- The mandate of international development organizations' programs in the Western Balkans should be more focused towards educational institutions, particularly by offering technical expertise to develop methodologies for qualification standards and creating learning materials. This will help institutions integrate the skills needed for modern economies.
- WB governments should promote the concept 'work-based learning' by supporting companies and vocational schools in the renewable energy sector, integrating apprenticeships into vocational education and training (VET) policies.
- Governments should mobilise private-public finance and funds for more resources to education infrastructure, especially focusing on high-demand sectors such as digitalisaion and renewable energy.
- The Western Balkans beneficiaries should proactively engage with EU programs like *Erasmus*+ and *IPA funds* to build capacity in adult education institutions, provide teacher training, and develop new education programs.
- National campaigns should promote lifelong learning and vocational training, especially in the renewable energy sector, by highlighting personal and economic benefits. This would thereby increase participation rates in adult education programs.
- Information campaigns should target underserved groups such as coal-based regions, low-income individuals, and unemployed workers, promoting subsidized or free education programs in the renewable energy sector.
- Vocational training programs should offer flexible learning pathways, such as part-time, evening, and modular courses, to accommodate adults with work and family responsibilities.
- Vocational training should focus on equipping adults with relevant skills to support the growth of solar and wind energy production.
- Governments should invest in ICT infrastructure to develop user-friendly digital and e-learning platforms, improving access to adult education, especially in rural and coal-dependent areas.
- Establishing more training centers across the region will improve adult learning accessibility, particularly in regions facing economic transition due to coal industry decline.

- Governments and international organizations should support non-formal education systems, such as online learning and micro-credential programs, to quickly respond to workforce shortages in renewable energy.
- Governments should provide financial assistance to companies facing challenges in finding qualified workers, reducing the cost burden of continuous education and skills development through internships and on-the-job training.

1. About this report

This study comes as an outcome of the project '*Green Agenda: Decarbonisation of the Electricity Sector in the Western Balkans',* funded by the German Ministry for Economic Cooperation and implemented by the Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ), with the overarching aim to identify the labour market effects of decarbonisation of the electricity sector in the Western Balkans (WB). The study focuses more to address the following objectives:

1. To estimate the potential job losses in the energy sector due to the phasing out of fossil fuels and to assess the job creation potential in the renewable energy sector.
2. To identify the essential skills required in the energy workforce, as well as to analyze current skill gaps.
3. To examine the key challenges and opportunities in macroeconomic context and the alignment of the supply of energy sector professionals with the evolving demand for skills in the renewable-based technologies.

The joint consortium of CETEOR and IRMO, on behalf of GIZ designed and performed this comprehensive labour market assessment to assess the expected impacts on employment and growth of a RE-based energy transition and the required qualifications of skilled workers. The assessment is based on the current labour market situation in the Western Balkans' renewable energy sector, and projects labour market development up to 2030.

A mixed and comprehensive method approach analysed macroeconomic drivers, the energy sector labour market, skills development programs, and workforce projections for NECP renewable energy targets. Each step concluded with results validation and writing the final analysis report. A side-event with energy and education partners was organised at the end of this process, which further validated the findings and recommendations of this study. The methodology path as outline in the chart below:

The results are expected to support decision-makers in the field of education and energy, as well as Technical and Vocational Education and Training (TVET) actors of WB countries in increasing their readiness to train or skill up the incoming labour force needed for a renewable-based energy

transition. In addition to using the GIZ analytical tool ELMA, the Consultant's own projections are implemented based on IRENA and ILO methodologies.

This analytical report is structured in 8 chapters. Following this introduction, the upcoming chapter provides the landscape of energy transition. This includes a presentation of the current electricity mix as well as commitments made primarily under the EU integration process and other multi-lateral frameworks.

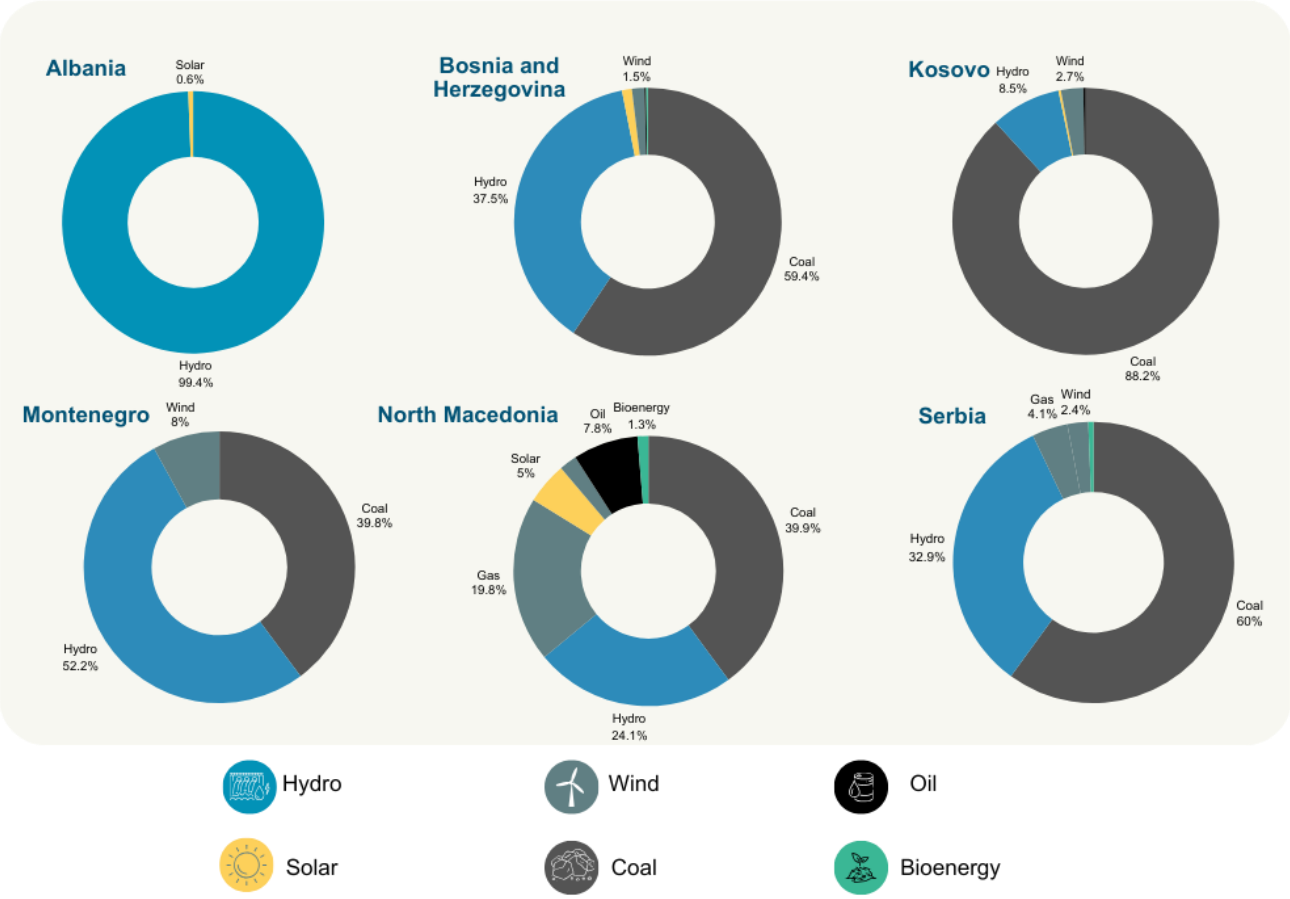
The third section outlines economic and demographic factors that influence the workforce demand and supply in the electricity production sector, as well as the political and institutional drivers and challenges of a renewable-based energy transition. As the focus of this analysis are labour market effects, sections 4 (from the demand side) and 5 (from the supply side) go into further depth about current developments. The lack of a legally binding domestic framework and timeframe for decarbonisation has been identified as a barrier to the faster penetration of RES. Section 6 provides an overview of the development of the renewable energy sector in the WB countries, as infrastructure development is directly proportional with the number of jobs.

Section 7 provides an estimation of the potential for job creation in the renewable energy sector (solar, wind and hydro) by 2030 in Western Balkan countries. The following three approaches are used: 1) based on EU multipliers, employment factors and 2) direct and 3) indirect jobs. The findings are coherent with previous studies' analysis and show significant job creation potential, primarily related to solar energy. Section 9 summarises the key findings and provides policy recommendations. Decarbonisation of the electricity sector requires decentralisation of power generation infrastructure, increased diversity of actors, more employment, implementation of new technologies and operating rules in transmission and distribution grids.

2. The landscape of energy transition in the Western Balkan region

The Western Balkan (WB) countries who are implementing the EU's energy and climate acquis under the legally binding Energy Community Treaty, have strategically planned their energy, transport, and industry sectors to phase out fossil fuels and increase the share of renewables. However, due to their oil and fossil gas dependency and legacies from the socialist system when energy prices were below the market prices because they were subsidised, they are ill-prepared to implement a socially just energy transition that demands not only a decarbonised, but also decentralised and democratic energy system.[4]

The WB region's energy systems rely heavily on coal and hydropower. Kosovo, Serbia, Bosnia, and Herzegovina are in the world's top ten in terms of coal share in electricity production,



*Note: *All data refer to the latest year available (2023 for all countries except for Albania for which the year 2022 is presented)*
Source: Our World in Data ***Figure 2: Electricity production by source (%), 2023****

[4] CAN EUROPE (2024). Overcoming barriers for renewable energy deployment in the Western Balkans: The case of North Macedonia and Serbia. Available under: https://caneurope.org/content/uploads/2024/01/Study-on-Barriers-for-Deployment-of-RES-in-the-Western-Balkans.pdf

with 88.2%, 60% and 59.1%, respectively (BiEPAG, 2023[5] and Our World in Data), while North Macedonia (39.9%) and Montenegro (39.8%) have relatively more balanced energy mixes (see Figure 2). Albania depends nearly entirely on hydropower for electricity generation, with new renewables (primarily solar and wind) lagging significantly behind. Nuclear is non-existent in all countries.

Hydropower is now the most developed renewable energy source in the Western Balkans, accounting for a substantial part of electricity output in countries such as Albania (99.4%) and Montenegro (52.2%) (see Figure 2). It has been determined that the region has an estimated 80,000 GWh technical potential, concentrated predominantly in the mountainous regions of Montenegro and Albania[6]. In general, Bosnia and Herzegovina can have a hydropower potential of more than 6,000 MW, of which only 2,504 MW is currently exploited.

However, further development of the hydropower is faced with several issues and limitations:

- Outdated powerplants that need upgrading.
- Relatively small installed hydro-power capacities when compared with the total estimated hydro-power potential, and underdeveloped infrastructure, policy and regulatory framework needed to enable utilization of that potential.
- Some countries, such as Kosovo, are limited in using the hydro potential for electricity generation due to transboundary issues, population resistance, and ecological concerns.
- Almost all companies have limited transmission infrastructure capacity to connect new renewables to the grid.

  River's fragmentation, which negatively affects biodiversity and ecosystem health, has an even higher negative cumulative effect in the case of several mini-hydro powerplants on one river.

The shift in renewables share has generally increased in the WB region but unevenly with the solar sector showing the greatest rise compared to 2019. Solar energy is one of the most underutilized renewable resources in the region, despite its high solar insolation.

The WB countries have committed to decarbonising the electricity sytems in compliance with EU directives, the Energy Community Treaty and other international obligations such as the Paris Climate Accords. Albania, Montenegro, and North Macedonia have joined the Powering Past Coal Alliance launched by Canada at the COP23 summit in 2017. In addition, the Energy Community Treaty contains provisions to limit and reduce emissions from thermal power plants. However, comprehensive policies have yet to be developed. The Western Balkans countries' Energy Community target commitments are not fully transposed into national plans. Concrete

[5] BiEPAG (2023). Background paper, May 2023. ENERGY IN THE WESTERN BALKANS. Available under: https://www.biepag.eu/wp-content/uploads/2023/05/Energy-in-the-Western-Balkans-2.pdf

[6] (PDF) Hydropower Potential in the Western Balkans- Policy and Implementation (researchgate.net)

commitments to phase out coal and reduce outputs have yet to be established within the period covered by the National Energy and Climate Plans (NECPs). Only the modernisation of existing capacity is envisaged (e.g. the installation of scrubber systems to reduce CO_2 and SO_2) [7] is planned. In July 2024, the Serbian government adopted the Integrated National Energy and Climate Plan (NECP) until 2030 with projections until 2050. The plan is expected to cut greenhouse gas (GHG) emissions by 40.3% compared to 1990. Serbia aims to invest in renewable energy sources and to add around 3.5 GW of new solar and wind power capacity by 2030 to generate nearly half (45%) of its power from clean sources. Renewables should reach 33.6% of the gross final energy consumption by 2030, and the share of lignite in power generation should be reduced by 25% by 2030 (compared to 2019). However, Serbia avoided clear commitments in its draft NECP regarding ceasing coal-based energy generation or carbon pricing, and the energy efficiency and renewable energy targets included were less ambitious than those Serbia had agreed to at the 2022 Energy Community Ministerial Council.

In October 2020, the Sofia Declaration on the Green Agenda for the Western Balkans[8] was adopted. This Declaration outlines the political aim of aligning with EU climate legislation to achieve carbon neutrality by 2050 and reach energy and climate targets by 2030. The energy

We're going to have to get rid of coal-powered plants. We are threatened with taxes (CBAM). I was at a meeting with GIZ and the Romanian and Bulgarian embassies and they all convinced this is very good for us. We asked, please take us to some city in Romania where they closed the TTP to see how well people live. The decommissioning of TTP will have tragic effects on the labour market. The energy sector is political prey for parties as they come to power, and everyone needs to satisfy their appetites. There is a shortage of workers, and we have a surplus, which is a paradox. You have a company for solar energy. It has 570 employees, 450 of them are not working, but we still lack solar panel assemblers. That mid-level professional staff is missing. Regarding the energy transition, our country has already issued many permits for solar power plants. But no one is talking about that there must be a stable energy source behind the solar power plants; it will probably be a nuclear power plant from Germany that will provide for our energy system stability, and we will buy electricity from them.

Key Informant Interview

transition is expected to have a social and economic impact, including job creation in the renewable energy sector, potential shifts in employment from traditional energy sectors, changes in relative prices (caused by carbon pricing) and broader socioeconomic changes in countries traditionally relying on coal mining. Furthermore, the Sofia Declaration calls for continued alignment with the EU Emissions Trading Scheme as well as the implementation of other pricing instruments at the regional level to promote decarbonisation. For example, thus far, only Montenegro – which sees itself as the regional pioneer in implementing EU energy and climate acquis – has implemented a national cap-and-trade scheme.[9] These measures aim to create a more predictable and stable investment environment for renewable energy projects while ensuring that the social impacts of energy transition, such as job displacement, are managed through targeted policies and support programs. WB countries will also be subject to Carbon Border Adjustment Mechanism (CBAM), which will take full effect in 2026. This will change relative

[7] Bechev D. (2023). The Green Transition and the Western Balkans. Published in October, available under https://carnegieendowment.org/research/2023/10/the-green-transition-and-the-western-balkans?lang=en&center=europe

[8] Sofia Declaration on the Green Agenda for the Western Balkans (2020). https://www.rcc.int/docs/546/sofia-declaration-on-the-green-agenda-for-the-western-balkans-rn

[9] Bechev D. (2023). The Green Transition and the Western Balkans. Published in October, available under https://carnegieendowment.org/research/2023/10/the-green-transition-and-the-western-balkans?lang=en&center=europe

prices and can impact the pace of renewable-based transition and other industries. For the Western Balkans, industries that are heavily reliant on carbon-intensive processes may face increased costs, potentially accelerating the shift to renewable energy sources to remain competitive in the EU market.

Renewable-based energy transition will significantly affect the labour market in WB. Most coal power plants will need to be decommissioned over the next decade due to legal violations, age, and poor performance[10]. To handle layoffs in a sector already plagued by overemployment, governments must have clear strategies and roadmaps in place[11]. According to the Joint Research Center data, around 138,000 jobs are linked to coal in WB countries (90,000 in the mining industry and 49,000 in coal-based thermal power plants - TPPs). It is estimated that phasing out coal in accordance with EU policy might lead to the loss of 0.4% of the total workforce in Montenegro, 0.5% in North Macedonia, 0.6% in Serbia, 1.3% in Bosnia and Herzegovina, and 1.4% in Kosovo[12] [13].

Some of the interviewed key informants are concerned about the negative effects of the energy transition, such as job losses, the inability to create new jobs with renewable technologies, and the negative effects that the decommissioning of TTPs will have on the stability of the national electricity network and supply.

Regarding jobs, the green transition advocates are against small and large hydroelectric power plants and we are left with solar and wind turbines. Which jobs are provided by the solar power plant – the guardian and the director. Wind plants - they only need people who handle the monthly reporting. The transition does not create new jobs.

Key Informant Interview

KIs believe the effects on their energy systems and labor markets will be far larger than on some big economies. According to the OECD, the number of jobs in the coal and conventional power sector is already declining. In Serbia, more than 3,000 jobs were lost in the Kolubara mining basin between 2017 and 2019; in the Kostolac mining area, the number dropped from 2,000 in 2009 to

We are a small system, too small to apply all the rules made for big countries. Poland have threatened to leave because 2 million people work in sectors related to thermal power plants. Our country will be more affected than them.

Key Informant Interview

about 1,500 in 2019, despite the developments of new mines and improved production capacity.

[10] Ruiz Castello, P., Medarac, H., Somers, J. and Mandras, G., Recent trends in coal and peat regions in the Western Balkans and Ukraine, EUR 30837 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41929-7, doi:10.2760/81752, JRC126154.
[11] CEE Bankwatch Network (2022). THE WESTERN BALKAN POWER SECTOR. Between crisis and transition. Available under: https://bankwatch.org/wp-content/uploads/2022/12/2022-12-05_The-Western-Balkan-power-sector.pdf
[12] Ruiz Castello, P., Medarac, H., Somers, J. and Mandras, G., Recent trends in coal and peat regions in the Western Balkans and Ukraine, EUR 30837 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41929-7, doi:10.2760/81752, JRC126154.
[13] For summarised information see also BiEPAG (2023).

Montenegro's mineworker population has decreased by almost half, from 1 200 in 2010 to 670 in 2019[14]. This is a consequence of a confluence of circumstances arising from restructuring, environmental legislation, and the move to renewable energy for an aging workforce.

Furthermore, as the EU's Green Deal and Green Agenda for the Western Balkans place a strong emphasis on the growth of the renewable energy sector, the green jobs in energy sector are spotlighting great demand. According to the European Training Foundation (ETF) and the International Renewable Energy Agency (IRENA), solar photovoltaics (PV) employed most people in renewable energy worldwide in 2020, followed by bioenergy and hydropower.[15] The push for renewable-based energy transition promises new employment opportunities, as renewables are labor intensive. Renewable energy projects, such as solar and wind farms, tend to be more distributed geographically and require activities to deploy and maintain such technologies, as well as the significant construction and installation efforts involved. .his job potential could be tapped to offer new opportunities in current mining regions. However, in that process, the WB countries lack the comprehensive strategies and frameworks for Just Transition, which are crucial for transforming the challenge of renewable-based energy transition into opportunities for sustainable employment and offer a structured approach to mitigating the socio-economic consequences of moving away from coal. EU member states (e.g. Greece, Poland, and Bulgaria) experience could serve as robust models for WB countries, offering practical insights into managing the complex socio-economic dynamics involved in the coal phase-out[16][17].

In Serbia, there has been no discussion about just transition and addressing the effects of energy transition on jobs in coal-based energy production.

Key Informant Interview

The development of renewable energy sources in the WB is strategically important for various reasons (including economic and environmental). Still, this report focuses on the specific labour market effects of the renewable-based energy transition. Following the Employment and Labour Market Analysis (ELMA) methodological guideline and toolbox (GIZ), the assessment team will cover the following aspects related to the renewable energy sector development effects on labour market: framework conditions (including geography aspects; governance, political and institutional situation; macroeconomic development and demographic trends), labour market trends both the demand and supply side and matching of these two. The report ends by recommendations and outlining the key constraints and opportunities.

[14] OECD (2022), Multi-dimensional Review of the Western Balkans: From Analysis to Action, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/8824c5db-en.
[15] UNICEF (2023). A Gender Mapping of the Green Economic Transition in Europe and Central Asia. Available under https://www.unicef.org/eca/media/33571/file/A%20Gender%20Mapping%20of%20the%20Green%20Economic%20Transition%20.pdf
[16] The "Just Transition Plans" for Greece, Poland and Bulgaria, developed by the World Wildlife Fund's Regions Beyond Coal initiative offer roadmaps for achieving a just transition through transforming coal regions and creating new, sustainable employment opportunities.
[17] OECD (2022), Multi-dimensional Review of the Western Balkans: From Analysis to Action, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/8824c5db-en.

4. Macro-economic and institutional quality

The labour market in the renewable energy sector in the Western Balkans is shaped by a complex interplay of geographic, macroeconomic, institutional, demographic, and political factors, all of which must be assessed to determine the potential of the renewables sector for employment generation.

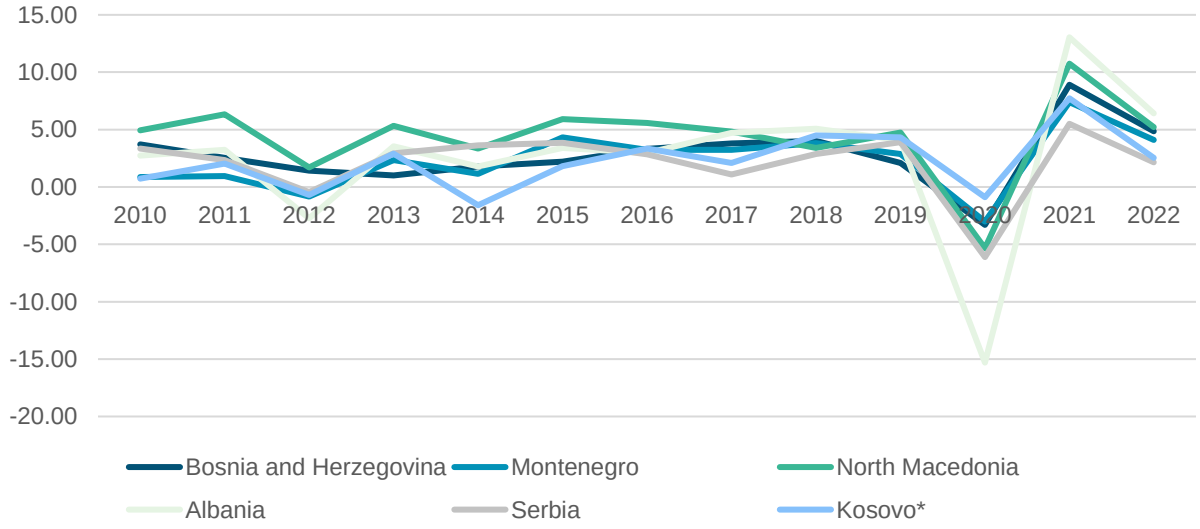
Although the region's diverse geography and natural resources endowment offer significant potential for renewable energy, the main challenges that persist are related to the socio-economic and political factors. Economically, although the need for diversification and job creation drives interest in renewables, financial constraints and reliance on traditional energy sources can hinder progress. Demographic trends, such as ageing populations and emigration of skilled youth, further complicate workforce development, necessitating targeted retraining, reskilling and retention policies. Politically, stability, good governance and commitment to the EU's Green Agenda are crucial for encouraging investment and adopting supporting policies, making political will a key determinant in the successful expansion of the renewable energy sector and its labour market.

Economic situation

The Western Balkan countries macroeconomic stability and economic growth have a significant impact on the region's labour market and capacity to establish and maintain renewable energy projects. The economic environment, including fiscal policies, investment climate, and infrastructure, has a direct impact on the demand for labour in the renewable energy sector and the broader economy.

From 2010 to 2022, the Western Balkans region has seen varying levels of economic development, with some countries experiencing significant growth while others faced economic stagnation or decline (*Figure 4*). Moreover, they proved to be vulnerable to external shocks, as seen especially during the COVID-19 pandemic period.

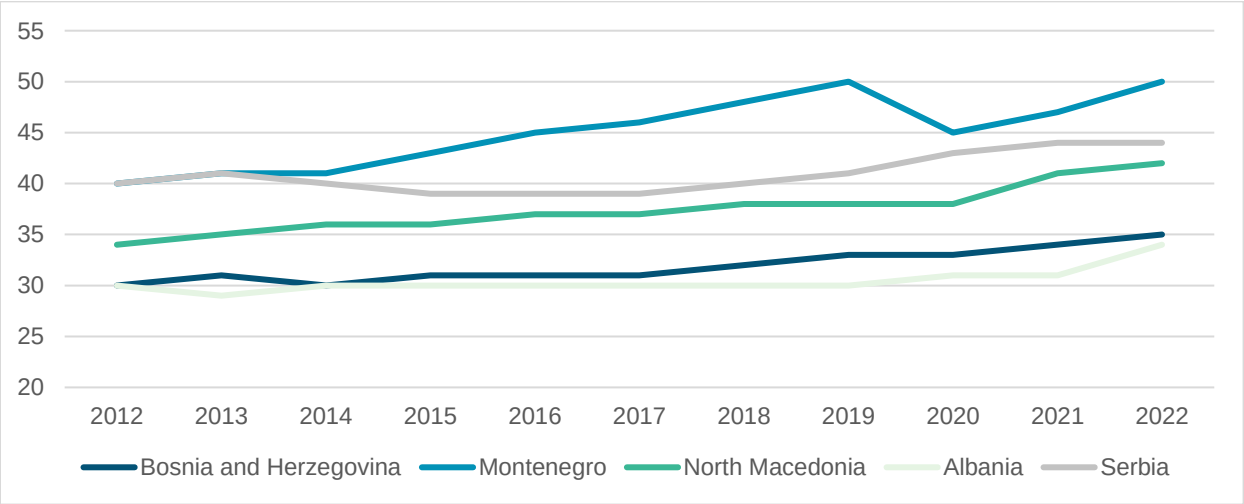
Figure 4. Real GDP growth



Source: Eurostat data

To develop a renewable energy-based labour market in the Western Balkans, it is critical to solve the underlying economic and institutional issues that are now impeding the region's progress. Strategic investments in infrastructure, education, institutional capacity development, and business-environment transformation are crucial. All six WB countries have a gross domestic product (GDP) per capita that is less than half the EU average (Figure 5). The root cause is low productivity as a result of years of under-investment, weak institutions, unfavourable demographics and an unfavourable business environment. Although the GDP gap between the WB countries and the EU has reduced over the last two decades, convergence has stalled since the global financial crisis in 2008 - 2009. According to some estimations, recent growth trends could be 70 years or more before the WB catches up with the EU.[18]

Figure 5. GDP per capita, PPP (EU=100)

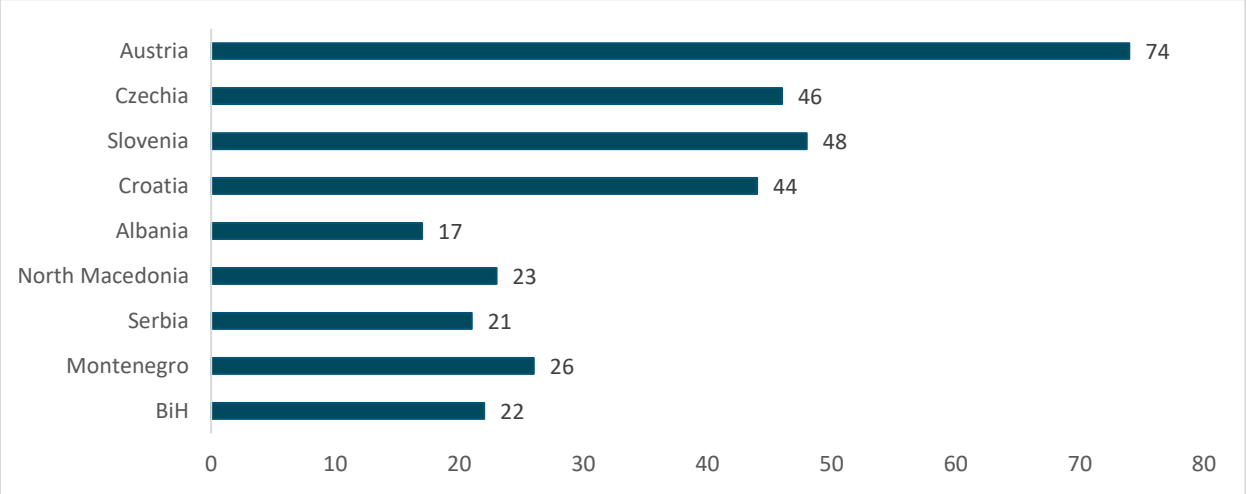


Source: Eurostat database

The fundamental problem facing WB economies is low productivity. Since 2001, the labour productivity gap between the EU-27 and the WB has been relatively stable[19]. Labour productivity is a measure of the amount of output (measured in Gross Domestic Product, GDP) produced per unit of labour (measured in terms of the number of employed persons or hours worked) during a specific time period. This measure helps users analyse the relationship between GDP and labour input levels and their growth rates over time. It provides general information about the efficiency and quality of human capital in the production process within a specific economic and social context, taking into account other complementary inputs and innovations used in production. Comparison with the neighbouring and EU member countries indicate that labour force productivity in WB6 is low and could benefit from workforce upskilling.

[18] EBRD (2024). Can the Western Balkans converge towards EU living standards?. Available under: https://www.ebrd.com/news/publications/special-reports/can-the-western-balkans-converge-towards-eu-living-standards.html
[19] EBRD (2024). Can the Western Balkans converge towards EU living standards?. Available under: https://www.ebrd.com/news/publications/special-reports/can-the-western-balkans-converge-towards-eu-living-standards.html

Figure 6: GDP per hour worked (GDP constant 2017 international $ at PPP) in 2023



Source: ILOSTAT Statistics on labour productivity - ILOSTAT

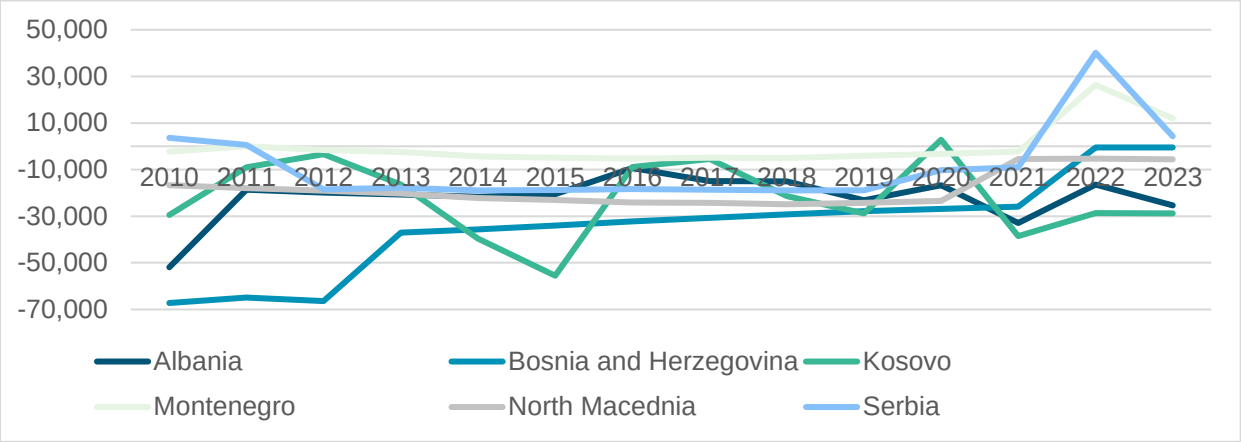
The region has seen decades of underinvestment, particularly in infrastructure and the energy sector. Businesses face deeply entrenched challenges such as corruption, informality, and a lack of public-sector administrative capacity that are difficult to reform. Most countries in this region have also seen depopulation since the 1990s due to declining birth rates and large emigration outflows. These are all factors that need to be considered when assessing the RES labour market development.

Demographic development

The Western Balkans region faces many demographic challenges, including high emigration rates, low birth rates, and an aging population. These trends have significant implications for the region's economic and social stability. They also have implications for the region's transition to renewable energy, particularly regarding the availability of workforce, skills development, and the long-term sustainability of the energy sector.

Emigration, especially of young, educated individuals, is a critical issue in the WB countries, where all countries except Serbia and Montenegro have negative net migration (see Figure 7). Kosovo, for example, while being the youngest country in the region with a median age of 29, is also faced with emigration concerns. The emigration of skilled workers causes a loss of human capital in the region, essential for the growth of emerging industries like renewable energy sector jobs. The net migration out of the Western Balkans continues accelerating, further depleting the region’s human capital. According to the World Bank data, all countries will record negative net migration up to 2050.

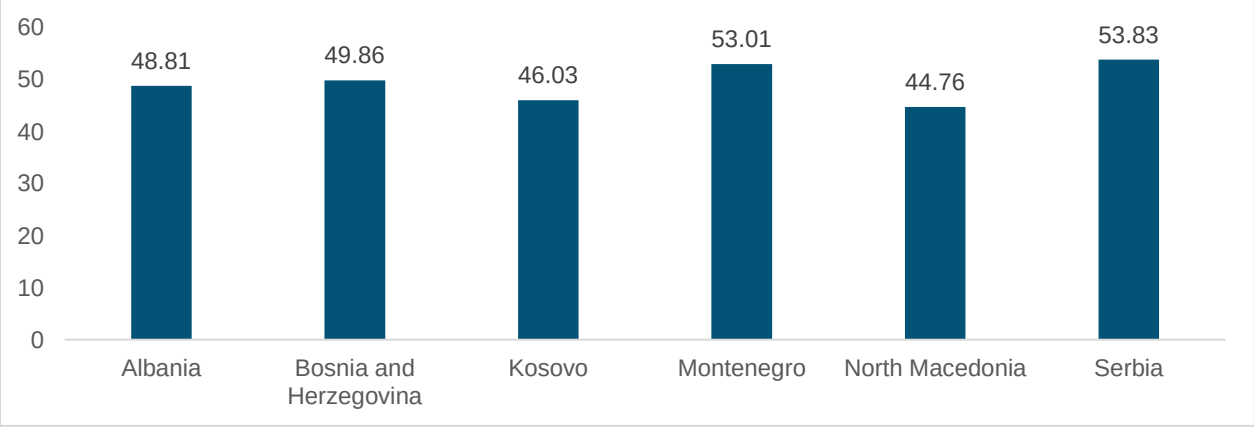
Figure 7. Net migration, 2010-2021 (number of immigrants minus the number of emigrants)



Source: Our World in Data

Furthermore, the age dependence ratio[20] is also high, implying that fewer working-age individuals will be available to support the elderly population. This is further expected to create substantial fiscal pressures due to higher pension and healthcare costs (Figure 8). Aside from tightening the already precarious budgetary situation[21], the Western Balkans' renewable energy sector faces challenges as its population ages. As the labour force ages, there may be a scarcity of young, skilled workers needed for labour-intensive phases of renewable energy projects, such as installation, maintenance, and operations. Additionally, older workers may need retraining to adapt to new technologies in the renewable energy sector.

Figure 8. Age dependency (% of working age population), 2022 data

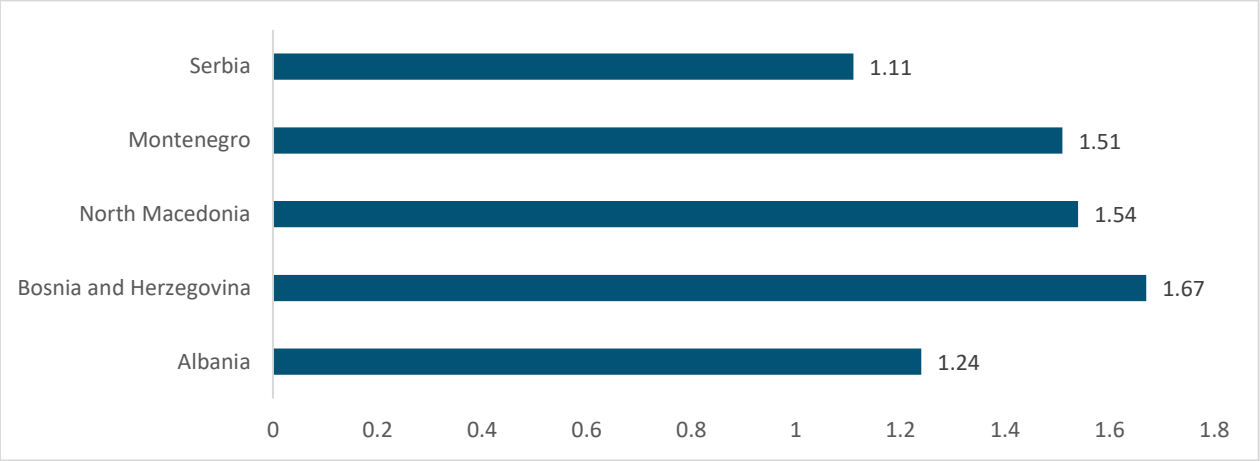


Source: World Development Indicators

[20] The age dependency ratio is the sum of the young population (under age 15) and elderly population (age 65 and over) relative to the working-age population (ages 15 to 64).Data are shown as the number of dependents per 100 working-age population.
[21] The level of public debt varies significantly across the region. Montenegro and Albania have relatively high debt-to-GDP ratios (60.3% and 59.2% of GDP, respectively), limiting their fiscal space and ability to invest in infrastructure, including renewable energy projects. On the other hand, Kosovo (17.2%) and Bosnia and Herzegovina (26.9%), have lower debt levels (Eurostat database).

A higher labour dependency ratio indicates that the employed worker faces a greater burden supporting the economically inactive population. BiH has the highest labour dependency ratio; one employed worker sustains 1.67 economically inactive persons.

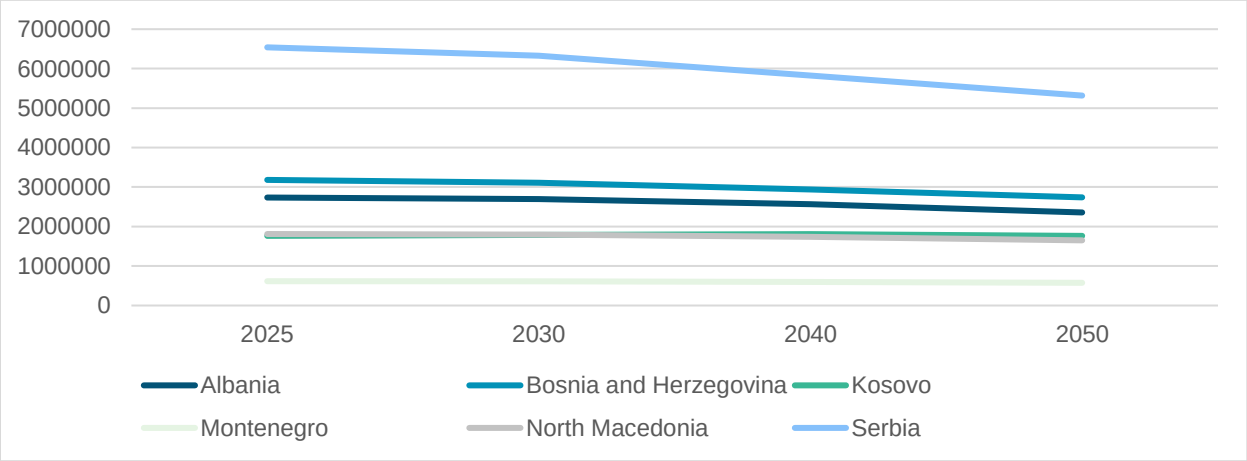
Figure 9:Labor Dependency Ratio[22]



Source: ILOSTAT Data Explorer

Finally, most countries in the region are expected to experience population declines in the coming decades (up to 2050), which could lead to labour shortages, particularly in technical and skilled positions critical to the development and maintenance of renewable energy infrastructure. Figure 7 shows that Serbia has the highest population loss.

*Figure 10. **Population projections up to 2050***



Source: World Bank

[22] The ratio of the inactive population to the active population at all ages.

Political situation and business environment

WB countries have a complex political landscape characterised by continuous difficulties such as ethnic conflicts, political instability, and the influence of external actors. Political instability hampers Western Balkan countries' ability to implement and sustain long-term policies for energy transition. This leads to inconsistent policy-making and implementation, further undermining investor confidence, which is crucial for funding energy related projects.

The Western Balkans have been working to enhance their regulatory framework for renewable energy. Most countries in the region have set targets for renewable energy to encourage investment. Nevertheless, they continue encountering challenges due to uneven policy implementation and bureaucratic hurdles. It is essential to synchronize regulations with EU standards as the region moves closer to EU accession for continued growth. This is particularly critical for foreign direct investment (FDI), which serves as a key catalyst for economic expansion in the Western Balkans. The table 1 shows data on net inflows of FDI in WB countries and we can see that Serbia records the largest inflow, and Kosovo the lowest. Although not available, it would be of great interest to have an insight into which percentage of FDI falls on RES.

*Table 1. **FDI inflows (data for 2023)***

Country	FDI Inflows (2023, USD Billion)
Albania	1,2
Bosnia and Herzegovina	0,9
Kosovo	0,6
Montenegro	0,8
North Macedonia	1,1
Serbia	3,3

Source: UNCTAD statistics

The existing research shows that globally, the growth in jobs created by FDI since 2010 has been highest in the renewable energy sector, so in this context, governments are urged to shape their investment promotion efforts around renewable energy sources industries[23]. In 2023, in the Western Balkans, a record of 22 greenfield FDI renewable energy projects were announced, according to fDi Markets (significant growth from 13 projects a year earlier and 7 projects in pre-pandemic 2019)[24].

When it comes to the quality of institutions, which are crucial for investment climate, EBRD[25] measures progress in each country across six desirable qualities of a market economy: competitive, well-governed, green, inclusive, resilient and integrated. The composite scores are

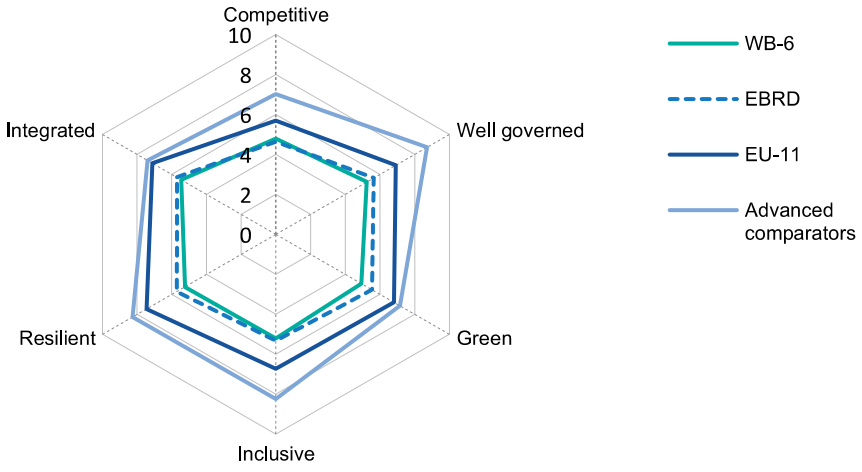
[23] Alex Irwin-Hunt (2023). Renewables has highest FDI job creation momentum. Available under: https://www.fdiintelligence.com/content/data-trends/renewables-has-highest-fdi-job-creation-momentum-83142

[24] Alex Irwin-Hunt (2024). Can the Western Balkans really export green power to Europe? https://www.fdiintelligence.com/content/news/can-the-western-balkans-really-export-green-power-to-europe-83533

[25] EBRD (2024). Can the Western Balkans converge towards EU living standards?. Available under: https://www.ebrd.com/news/publications/special-reports/can-the-western-balkans-converge-towards-eu-living-standards.html

calibrated from 1 (worst) to 10 (best). WB falls short at all six elements. The region's average scores range from 4.8 for competitive to 5.5 for integrated, which is close to the general average across the 36 EBRD economies in all six qualities but well below the averages for the EU-11 and even further behind when measured against the advanced comparator countries. The gaps are especially severe in governance, green, and resilience domains (Figure 11).

Figure 11 ***Market economy qualities (0-10)***



Source: EBRD (2024). Can the Western Balkans converge towards EU living standards?. Available under: https://www.ebrd.com/news/publications/special-reports/can-the-western-balkans-converge-towards-eu-living-standards.html

The governance aspects, which include the rule of law, regulatory quality, and the efficacy of government institutions, may have a direct impact on the renewable energy sector by creating an uncertain investment climate. For example, delays in obtaining licenses and permits for wind and solar projects can discourage investors and slow down the development of these projects and thus creating delay in unlocking the employment potential in RES sector. Additionally, weak governance can lead to corruption, which increases the costs and risks associated with renewable energy investments. Corruption is a pervasive issue across the Western Balkans, affecting all levels of government. It could obstruct the transparent and efficient use of funds allocated for renewable-energy-based transition projects and hinder the enforcement of environmental regulations. For instance, allegations of corruption in Montenegro and Serbia have slowed down the obtaining of permits and the implementation of renewable energy projects. Effective governance and the rule of law are thus essential for successfully transitioning to a green economy[26].

Another low score was reported in the green dimension, showing that the Western Balkans are not fully capitalizing on their renewable energy potential. This is partly due to a lack of public

[26] EBRD (2024). Can the Western Balkans converge towards EU living standards?. Available under: https://www.ebrd.com/news/publications/special-reports/can-the-western-balkans-converge-towards-eu-living-standards.html

awareness and support for renewable energy initiatives. Also, the resilience dimension measures the ability of economies to endure shocks, such as economic downturns or natural disasters. The Western Balkans rank low in this area, indicating their vulnerability to external shocks, including fluctuations in global energy prices and the impact of climate change. The lack of resilience in the Western Balkans makes the region more susceptible to disruptions in energy supply, which could be mitigated by developing a more diverse and sustainable energy mix. Renewable energy sources, such as wind, solar, and hydropower, can enhance energy security; however, building resilience requires significant investment in infrastructure, technology, and human capital. The low resilience score also highlights the need for stronger financial systems supporting long-term investments in the renewable energy sector.

The complex political and regulatory situation strongly affects the institutional capacity to address economic reform needs and support private sector development, which also brings significant implications for the development of the renewable energy sector. According to the latest World Bank Enterprise Survey data[27], political instability is among the top five obstacles to business in all WB countries except Albania. Along with political instability, the informal sector is also a major obstacle to doing business. Renewable energy projects, which often take a long time to develop, depend on consistent, long-term policies to be financially feasible. For example, investors in wind or solar farms would need guarantees that feed-in tariffs, subsidies, or tax incentives will stay in place for the duration of their projects. However, these policies are often subject to change in an unstable environment, causing uncertainty and higher risk. This uncertainty can lead to increased financing costs or discourage investors altogether, which slows down the growth of the renewable energy sector.

Thus, the development of the renewable energy sector is closely connected to macroeconomic and political stability and economic growth in the Western Balkans. By establishing a stable and predictable environment, the region can attract more investment in renewable energy, leading to increased economic growth and job creation.

Significant weight and expectations are placed on the resources provided by EU funding which place major weight on the renewable energy projects. On 8 November 2023, in addition to the existing investment packages under the Economic and Investment Plan, the European Commission approved a new Growth Plan for the Western Balkans. The plan, supported by 6 billion EUR in non-repayable loans and aid, aims to bring the countries closer to the EU by providing benefits of EU membership before accession, stimulating the region's economic growth and accelerating socio-economic convergence. The new Growth Plan is structured around four pillars focused on enhancing economic integration with the EU's single market, boosting economic integration within the Western Balkans through the Common Regional Market, expediting fundamental reforms, and increasing financial assistance to support the reforms through a Reform and Growth Facility for the WB[28]. One of these pillars is specifically focused on

[27] The World Bank. Enterprise Surveys. Available under: https://www.enterprisesurveys.org/en/data/exploretopics/biggest-obstacle
[28] EC (2023). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

energy and digital transition, so we can expect it will have a major role in energy transition towards renewables, including the employment generation.

Table 2 summarises the crucial challenges and opportunities of analysed aspects for RES employment generation.

Table 2. Summary of challenges and opportunities for renewables sector employment generation

	OPPORTUNITIES	CHALLENGES
Governance, Political, and Institutional Situation	• Institutional reforms aimed at fostering a supportive environment for renewable energy development • Strengthening institutional frameworks can improve transparency and attract more investments in renewable energy	• Political instability, as one of the largest obstacles for doing business in WB, can deter investment and slow the transition to renewable energy • High corruption
Macroeconomic Stability and Economic Development	• Growth Plan for the Western Balkans plus investment packages under the Economic and Investment Plan	• Economic volatility and limited fiscal space can restrict government investment in renewable energy infrastructure
Demography and Migration	• Targeted programs can provide a skilled workforce for the growing renewable energy sector • Reversing migration trends by creating attractive job opportunities in renewables can retain talent in the region.	• Aging population and youth emigration reduce the available workforce for renewable energy jobs • Brain drain (affecting the availability of skilled labour)

New growth plan for the Western Balkans. Available under: https://neighbourhood-enlargement.ec.europa.eu/document/download/8f5dbe63-e951-4180-9c32-298cae022d03_en?filename=COM_2023_691_New%20Growth%20Plan%20Western%20Balkans.pdf

5. Current labour market trends – demand side in renewable energy sector

The characteristics of labour markets in the Western Balkans region, as well as recent trends in employment and unemployment, are crucial for understanding the potential and constraints of the renewable-based energy transition. This chapter provides an overview of key indicators and recent trends within the WB countries' labour market in renewable energy sector, including overall employment rates, economic structure employment, (youth) unemployment, gender aspects of unemployment and informal sector employment.

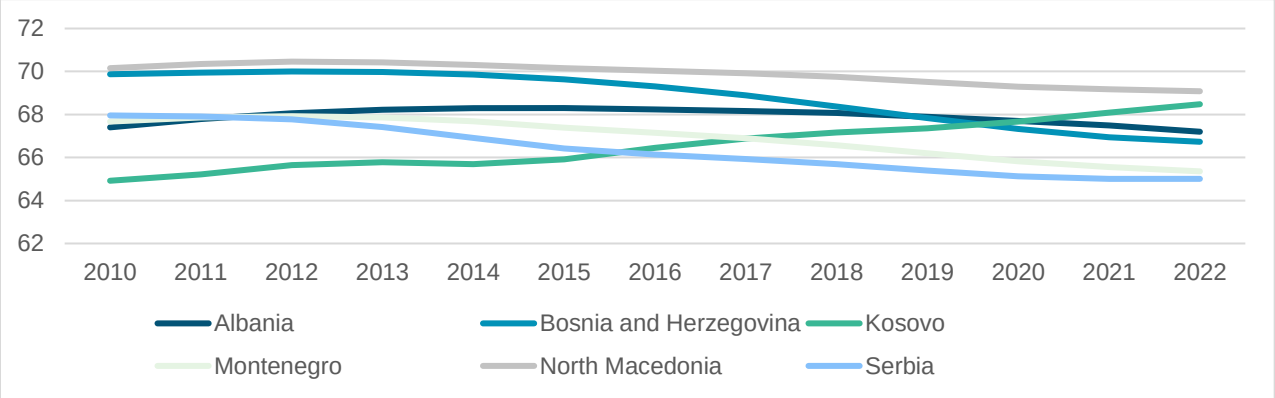
It should be noted that focusing solely on the renewable energy industry is difficult to quantify statistically because it cuts across entire sectors of the economy. Some renewable energy jobs are in primary sectors (i.e., bioenergy feedstock farming and harvesting), while others are in construction, utilities and manufacturing. Others are continuing to work in the service sector, which encompasses a vast agglomeration of different occupations and activities that range from installations to repair and maintenance, from financing to project management, etc. Additional jobs include public administration (support, standard setting and regulatory operations) and R&D.

Employment

As stated in the previous chapter, the WB is undergoing enormous demographic shifts that will have profound implications for its labour market. Although the labour market improved over the period, several structural issues remain (e.g. gender gaps, informality and high youth unemployment).

The prevailing demographic shift resulted in a decreased working-age population, creating potential labour shortages. Precisely, in 2022, the working-age population, defined as those aged 15-64, accounted for 65% of the total population in Serbia, the lowest share among WB countries. North Macedonia had the biggest proportion (69.1%) (Figure 12).

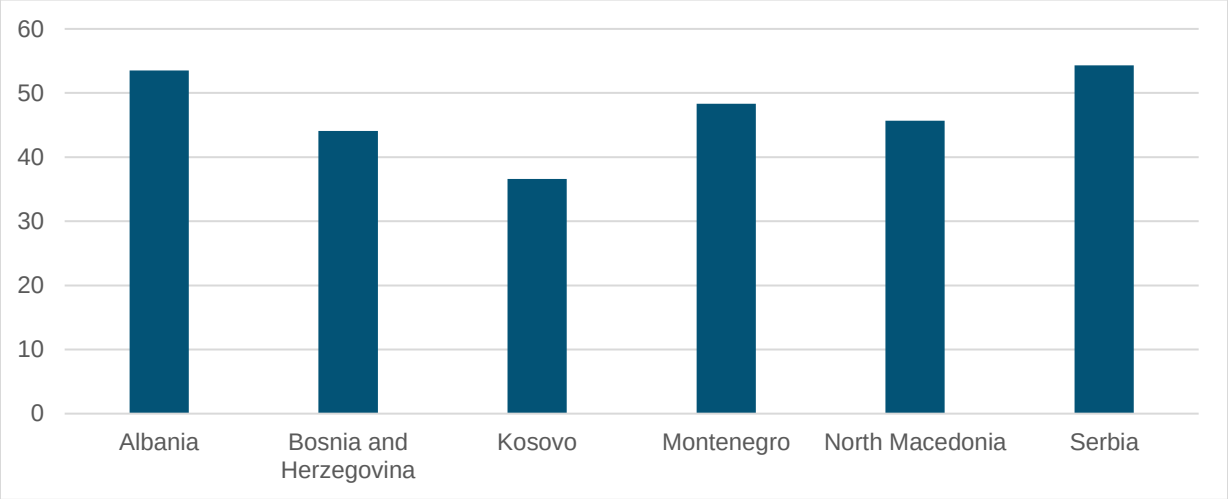
*Figure 12. **Working age population, 15-64 (%)***



Source: World Development Indicators

Figure 10 shows that employment rates in all WB countries are lower than the EU average (more than 70%). The lower employment rates indicate that a significant number of people of working age are either unemployed or not actively participating in the labor market. This situation can occur due to several factors, such as economic stagnation, limited job opportunities, skill mismatches, and a lack of investment in key sectors. The renewable energy sector, much like other rapidly expanding sectors, relies on a skilled workforce to develop, construct, and uphold energy projects. Low employment rates can present both a challenge and an opportunity for the renewable energy sector. First, a smaller active workforce may indicate fewer individuals with the necessary skills and experience for roles in the renewable energy sector. This potential shortage could lead to labour gaps in critical areas, such as engineering, technical maintenance, project management, and environmental science, potentially hindering the progress of renewable energy projects. On the other hand, the renewable energy sector has the potential to generate new job opportunities by integrating unemployed or underemployed individuals. By investing in the renewable energy sector, the Western Balkans countries can stimulate job creation, particularly in areas with high unemployment rates, thereby contributing to overall economic growth and increasing employment rates.

Figure 13. ***Employment rates (15-64 years)***



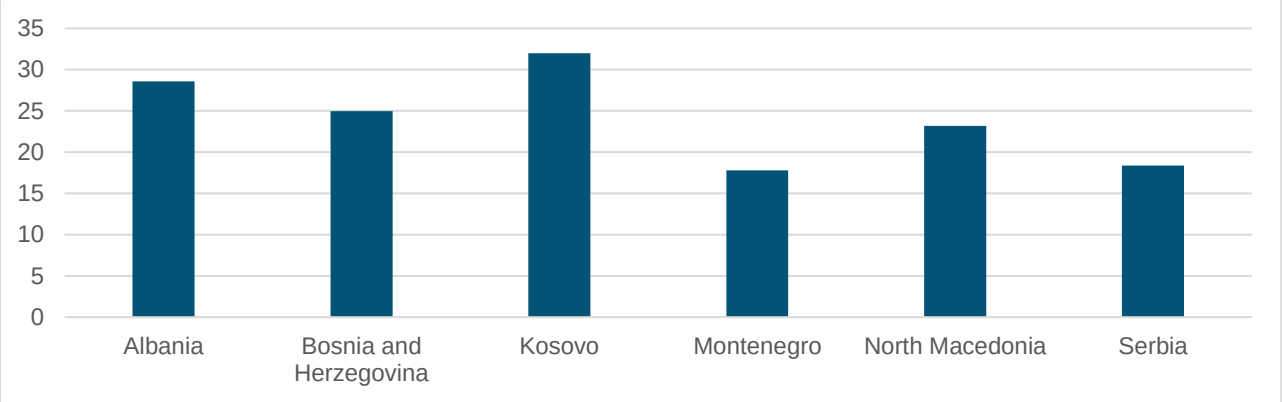
Source: World Bank Development Indicators

Youth unemployment

The region also faces high levels of youth unemployment and underemployment. This seemingly contradictory circumstance (high youth unemployment in the face of a shrinking labour force) indicates a mismatch between young people's talents and labour market needs. Figure 14 shows the share of youth that are not in education, employment or training (NEET). It can be observed that Kosovo has the highest percentage of NEET youth, whereas Montenegro records the lowest percentage. The high share of NEET indicates a gap between young people's skills and the labour market's future demands, which is particularly relevant for the renewables sector. Precisely, a high NEET rate can indicate that young people are not acquiring the skills most sought after by employers through education or training, which can result in an increased and sustained risk of

becoming disconnected from the labour market[29]. The renewables sector holds significant potential for youth employment, offering sustainable and future-oriented jobs. Training programs and educational initiatives focused on renewable energy technologies can help bridge the skills gap and reduce youth unemployment.

Figure 14. ***Share of NEET (% of total youth population), 2010-2022 average***



Source: Own calculation based on World Development Indicators

Employment by economic activity

In practically all WB countries, services accounted for the majority of the workforce (Table 3). Tourism is a significant contributor to the services sector, particularly in Montenegro and Albania (with indirect contribution of more than 20%).[30]

In Albania, agriculture, forestry, and fisheries employed a significant proportion of the entire workforce and were the second biggest employers.

Except for Kosovo and Montenegro, agriculture, forestry, and fishing are also major occupations in the Western Balkans.

Agriculture now plays an important role in the economics of the Western Balkans, particularly in Albania and Serbia, where significant rural populations rely on farming. However, agricultural productivity remains low due to fragmented land holdings, outdated technology, and limited market access. In all WB countries, the industry sector (mining and quarrying, construction, manufacturing, electricity, and water supply) became the second largest employer.

Due to the growing importance of the industry sector as a source of employment, there is potential for a transition towards jobs in the field of renewable energy. For example, the construction and manufacturing segments within this sector could prioritize the development of renewable energy infrastructure, such as wind farms, solar power plants, and energy-efficient buildings.

[29] OECD (2024), Western Balkans Competitiveness Outlook 2024: Regional Profile, Competitiveness and Private Sector Development, OECD Publishing, Paris, https://doi.org/10.1787/170b0e53-en.
[30] OECD (2024), Western Balkans Competitiveness Outlook 2024: Regional Profile, Competitiveness and Private Sector Development, OECD Publishing, Paris, https://doi.org/10.1787/170b0e53-en.

Workers already engaged in conventional industries are projected to need reskilling or upskilling to take on employment in the renewable energy industry.

*Table 3. **Employment by economic activity (in 000), 2022 data for industry sector***

	Mining and quarrying	Manufacturing	Construction	Total employment
Albania*	7,507	138,481	89,067	1264,67
Bosnia and Herzegovina	21,384	229,011	106,436	1296,466
Kosovo	3,762	36,25	45,015	415,465
North Macedonia	6,678	135,373	44,454	687,047
Montenegro*	1,418	12,664	24,153	243,792
Serbia	36,466	582,232	172,759	3083,317

*Note: *data for 2019*
Source: ILO

Table 4 shows the current unemployment rates (disaggregated by gender). Although both genders' unemployment rates among those aged 15 to 74 fell between 2012 and 2023, women's unemployment remains greater than men's, except for a slight difference in North Macedonia and Montenegro. Bosnia and Herzegovina and Kosovo have the greatest unemployment gender disparity in the area.

*Table 4. **Unemployment rates (%), 2023 data***

Country / last reported quarter	According to gender	Unemployment Rates (%)	Employment Rates (%)	Participation Rate (%)
Albania QII 2024	F	11,0	61.1	68.6
	M	11,4	72.5	81.8
	Total	2	66.7	75.1
Bosnia and Herzegovina QII 2024	F	17,3	41	49.6
	M	10,9	65.6	73.6
	Total	13,4	53.4	61.7
Kosovo* (2022)	F	16,5	18.4	22
	M	11,0	49.4	55.5
	Total	12,6	33.8	38.6
Montenegro QII 2024	F	12,9	56.9	65.4
	M	10,4	71	79.3
	Total	11,5	64.1	72.4
North Macedonia QII2024	F	11.7	49.1	55.6
	M	13,3	65.7	76.7
	Total	12.6	57.4	65.7
Serbia QII2024	F	8.6	60.9	66.6
	M	8.6	71.7	78.7
	Total	,5	66.3	72.5

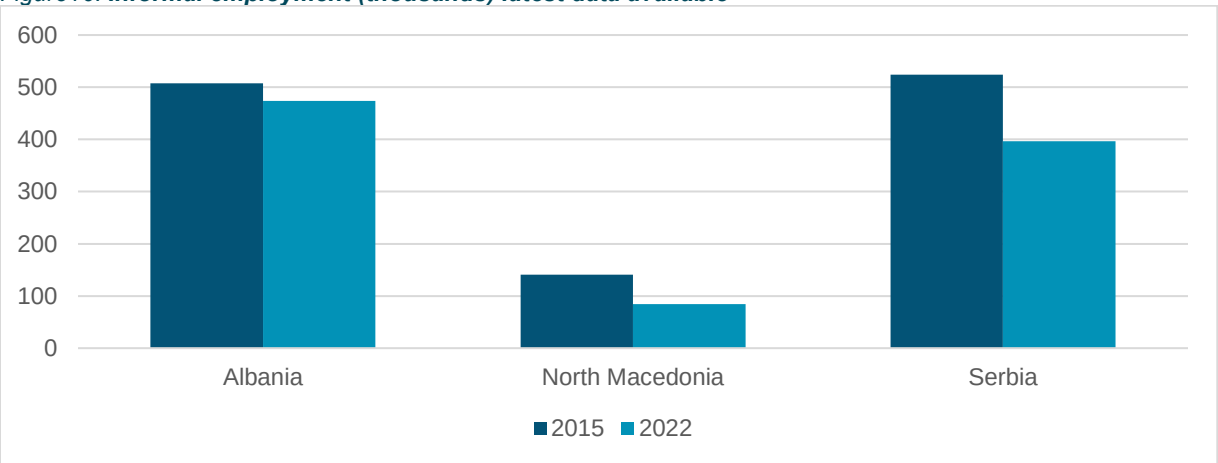
Note: Labor Force Surveys data for 2023and second quartal 2024
Kosovo: Kosovo in Figures 2023; Template for SOK publications in Albanian (rks-gov.net)
national statistical agencies; Press release (Professional design) (instat.gov.al)

The renewable energy sector presents a significant opportunity to address gender gaps in employment. Research indicates that renewable energy projects can create diverse job opportunities, from technical roles in engineering and maintenance to positions in project management. By actively promoting gender equality in hiring and training within the renewable energy sector, Western Balkan countries can reduce the unemployment gender gap and empower women economically. The IRENA 2019 RENEWABLE ENERGY: A GENDER PERSPECTIVE report[31] emphasizes the importance of gender-inclusive approaches in renewable energy projects.

Informal employment

The current dynamics of the informal sector may impede the transition to renewable energy. If a large portion of the workforce continues to work in informal employment, it could be difficult to incorporate these workers into formal renewable energy jobs. This is because such jobs typically necessitate formal contracts, specialized training, and compliance with safety and regulatory standards. In general, the informal sector in the region is still sizeable, ranging between 20% and 35% of GDP (OECD, 2024). Informal employment rates in the Western Balkans have historically been high compared to other regions. For instance, in 2019, the International Labour Organization (ILO) reported that informal employment rates ranged from around 30% in Albania to over 50% in countries like Bosnia and Herzegovina and North Macedonia (Figure 16). Several factors contribute to the prevalence of informal employment in the region. First, high unemployment rates and limited job opportunities in the formal sector push people towards informal work, while cumbersome regulations, high taxes, and administrative barriers make it difficult for businesses to operate formally.

Figure16. ***Informal employment (thousands) latest data available***



Source: SEE Jobs Gateway

[31] IRENA (2019). RENEWABLE ENERGY: A GENDER PERSPECTIVE. Available under: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf

As mentioned, informal employment often does not provide formal training and certification, leading to a mismatch between the skills available in the job market and those potentially required for renewable energy projects, which typically require specialised expertise in areas such as engineering, project management, and technical operations (skills that informally employed workers may not have). Thus, policies to formalise informal employment can provide workers with better access to training and development opportunities. This includes improving labour laws, offering incentives for businesses to formalize their workforce, and providing social protections for workers.[32]

Table 5 . Summary of challenges and opportunities for renewables sector employment generation

	OPPORTUNITIES	CHALLENGES
Current Employment Rates and Structure	• Potential for job creation in the renewable energy sector, boosting overall employment, especially in underdeveloped areas • Reskilling programs can help transition workers to renewable energy sector • Diversification of the economy by developing the renewable energy sector, reducing reliance on traditional industries • Growth in renewables can stimulate job creation across multiple sectors, including construction, manufacturing, and services.	• Resistance to change of existing workers in traditional sectors • Limited existing renewable energy infrastructure • The need for significant investment in new infrastructure and technology + limited financial resources
Unemployment Rates	• The renewable energy sector offers an opportunity to address gender disparities in unemployment, especially by promoting female participation in STEM • Targeted initiatives can be developed to encourage women's involvement in renewable energy projects	• Existing gender biases in STEM employment could limit women's participation in the renewable energy workforce • Women may face barriers in accessing the necessary training and education for renewable energy roles due to traditional gender roles and norms in the energy sector.

[32] Hanna, R., Heptonstall, P. & Gross, R. (2024). Job creation in a low carbon transition to renewables and energy efficiency: a review of international evidence. Sustain Sci 19, 125–150. https://doi.org/10.1007/s11625-023-01440-y

Informal Employment	• Renewable energy projects could formalize employment, reducing the informal economy's size and increasing job security • Formalization in renewables can improve working conditions, access to benefits, and worker protections in the region • Government and international support can drive formalization efforts by linking renewable energy development with formal employment requirements	• Informal workers may lack the skills needed for formal employment in the renewable energy sector, necessitating substantial training programs • Resistance to formalization due to higher taxes and stricter regulations may persist among businesses and workers accustomed to informal practices
Youth Unemployment	• The renewable energy sector can offer new job opportunities for youth, particularly in innovative and tech-driven roles. • Development of vocational training programs and apprenticeships in renewable energy can reduce youth unemployment • Specific youth-targeted initiatives can promote long-term career prospects in renewable energy	• High youth unemployment rates reflect a significant skills gap, making it difficult for young people to enter the renewable energy sector • Youth may be discouraged by the lack of immediate job opportunities in renewables

6. Current labour market trends – supply side

According to existing research, more human capital with the skills and expertise required for investment in renewables is needed in the Western Balkans. Precisely, there are shortages of skilled workers for installation, maintenance and quality assurance, in particular of solar panels and wind power. "To build such capacity, Western Balkan economies require appropriate curricula on renewable energy in technical, vocational, and tertiary institutions. This chapter outlines the key aspects related to the supply side of the labor market."

Education System Pre-primary or early child education (ECE) is related to kindergartens and preschools for children ages 3 and 6. It is not compulsory and is mainly administered by Municipalities / Towns. According to UNICEF pre-primary education provides the highest return on investment of all education sub-sectors[33].

Primary education is mandatory for children aged 6 to 15 and consists of 8 or 9 grades. Secondary education is not mandatory and caters to individuals aged between 15 and 18, with a duration of 3 to 4 years. It comprises general secondary education, vocational education, and technical education. Higher Education, or tertiary education, is related to education at Universities and colleges and provides bachelor's (3 years), master's (2 years), and Ph.D. (3 years) programs. Adult and continuing education covers various programs for adults, vocational retraining, and lifelong learning opportunities.

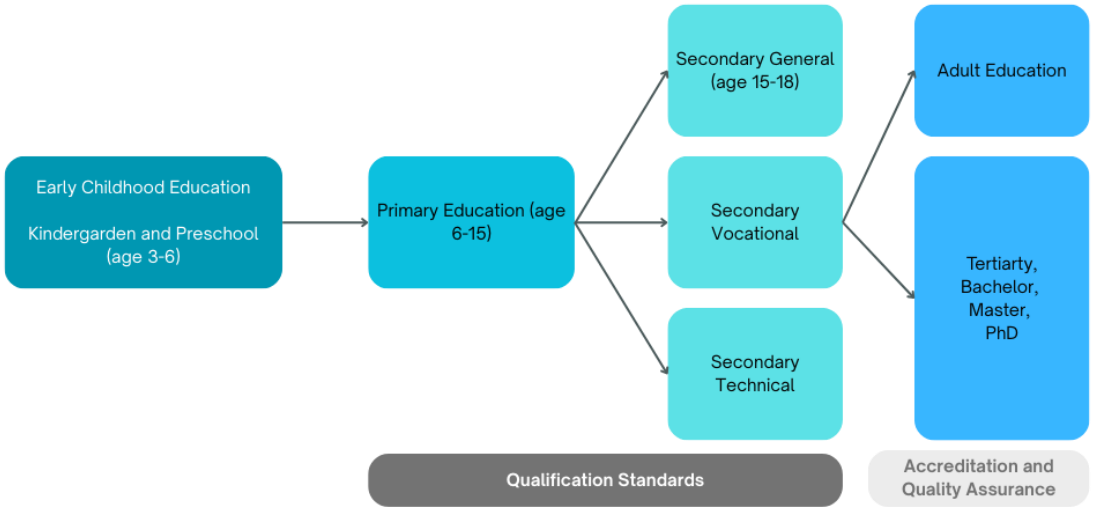


Figure 17. Education System

[33] Early childhood education | UNICEF

In the Western Balkans, students are divided into general education and vocational programs at the upper-secondary level. There are several unique aspects about this tracking system. Firstly, the vocational sectors in Western Balkans education systems are much larger compared to international benchmarks. On average, 59% of PISA-participating students in the region were enrolled in vocational schools, while the shares in CEEC, EU, and OECD countries were much lower at 23%, 17%, and 12% respectively. In Kosovo, upper-secondary education begins in grade 10, which is the first year students can enroll in a vocational education program. Additionally, education tracks in the Western Balkans are not interchangeable. Vocational and general education programs are usually housed in separate school buildings, and students are unable to switch their program of study or take select courses from the other. However, after completing upper-secondary education, students from either program are eligible to enroll in four-year bachelor's programs[34].

Governance and Administration of the Education Systems

In Albania, the Ministry of Finance and Economy is responsible for policymaking, establishing the legal framework, overseeing funding, and appointing directors within the VET system. The National Agency for Employment and Skills manages VET providers. Currently, there are no administrative structures for VET at the subnational level. The National Agency for VET and Qualifications (NAVETQ) is tasked with implementing the Albanian Qualifications Framework (AQF), which includes a catalogue of occupations, vocational qualifications, and related standards and descriptions. NAVETQ also develops curricula for all VET programs offered in the formal vocational education system, supports the creation of courses in vocational training centers, certifies and accredits curricula, and facilitates continuing professional development for teachers and instructors.[35]

In Serbia, the Ministry of Education is responsible for developing and implementing education policy. The National Education Council and Council for Vocational and Adult Education support the promotion and development of education. The Serbia National Council for Higher Education ensures the quality of higher education. The Institute for the Evaluation of Quality in Education evaluates education and provides recommendations for improvement. The Institute for the Advancement of Education monitors and improves the quality and development of the educational system. The Commission for Accreditation and Quality Assurance ensures the quality of higher education.

In Bosnia and Herzegovina, due to its complex administrative structure, there are twelve ministries/institutions responsible for education: the Ministry of Education and Culture of Republika Srpska, ten cantonal ministries of education in the Federation of BiH, and the Department for Education of the Brčko District Government. On a state level, there are also the

[34] OECD 2020; Education in the Western Balkans; Findings from PISA; Also available at: 764847ff-en.pdf (oecd-ilibrary.org)
[35] quality_assurance_in_vet_albania.pdf (europa.eu)

Agency for Development of Higher Education and Quality Assurance, the Center for Information and Recognition of Qualifications in Higher Education and the Agency for Preschool, Primary, and Secondary Education.

In Kosovo, the VET is managed as part of the overall education governance system. The Agency for VET and Adult Education (AVETAE) cannot currently manage all VET schools, as envisioned by the Law on VET. Still, it could potentially be upgraded to fulfil this role[36]. The Education and Training Administration (EARK) provides institutional funding for the eight Vocational Training Centres (VTCs) that it oversees and refers unemployed job seekers to these centers. The VTCs specialize in short courses. According to the ETF Report[37], the EARK does not have the capacity to oversee the entire adult training landscape or take a leading role in developing adult education offerings in Kosovo. Additionally, the tripartite Council for VET and Adult Education (CVETA) is not functioning as intended by the Law on VET..

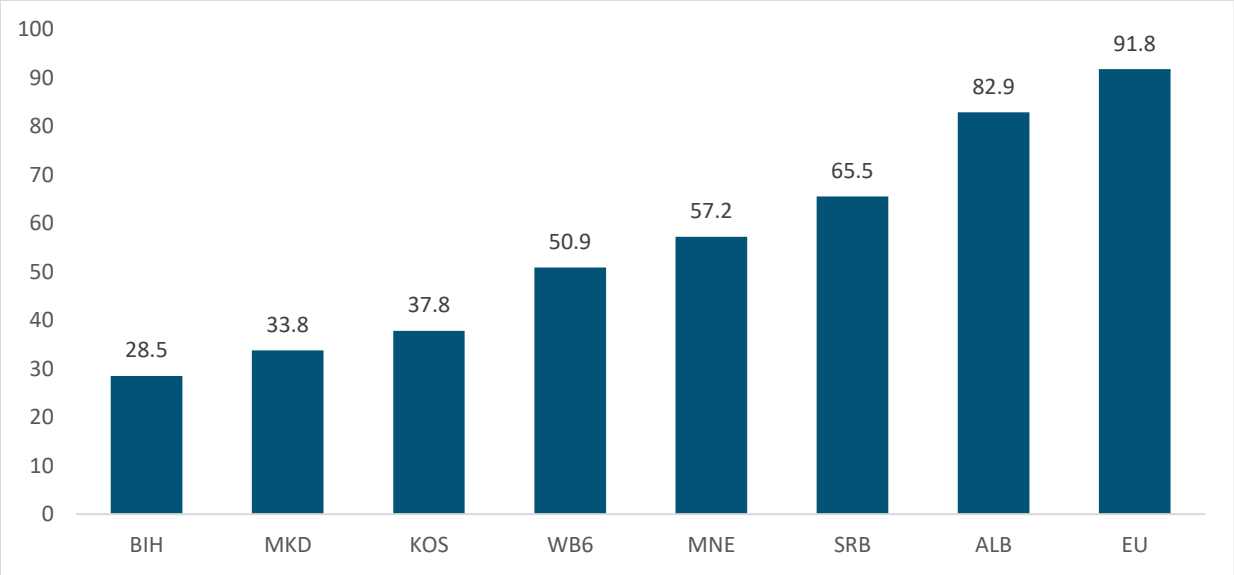
In Montenegro, the Ministry of Education, Science, and Innovation is responsible for planning, implementing, and revising education policies across all levels of education, from primary to higher education. To ensure the implementation of the quality of education policy, the government has set up the National Council for Education and the Council for Qualifications, responsible for advancing and developing higher education. It analyzes the situation and achievements in higher education and advises the Ministry and the government. Activities related to quality assurance in higher education are conducted by the Agency for Control and Quality Assurance of Higher Education, in line with the European Standards and Guidelines. There are also institutions ensuring the quality of education at the pre-school and primary school level (the Bureau for Educational Services) and institutions in charge of development, advisory support, and research in the vocational education of youth and adults (the Centre for Vocational Education).

In the Republic of North Macedonia, the Ministry of Education and Science is the main institution overseeing the secondary education and vocational education and training (VET) system. The Council for Vocational Education and the Council for Adult Education serve as platforms for stakeholder consultations and hold advisory roles. The VET Centre is tasked with developing occupational standards, qualifications, and assessment criteria and setting curricula for various VET levels. Additionally, the Centre for Adult Education is responsible for accrediting adult training programs and providers[38].

In early childhood education (ECE), enrolment rates range from 28.5% in Bosnia and Herzegovina to 82.9% in Albania, and the regional average of 50.9% was far below the EU average of 91.8%. (Figure 18). Moreover, regarding early childhood educational development programmes, the region's average enrolment rate falls to 34.6%, with only Serbia and Montenegro reporting rates above 50%.

Figure 18, ***Pre-primary enrolment rate (%), 2022***

[36] Country Fiche_Kosovo_2023_EN_web.pdf (europa.eu)
[37] Country Fiche_Kosovo_2023_EN_web.pdf (europa.eu)
[38] Country Fiche_North Macedonia_2022_EN_web_0.pdf (europa.eu)



Source: OECD, 2024

In 2021, four countries reported a higher proportion of persons aged 20-24 having attained at least an upper secondary level of education compared to the EU. Those were Montenegro (96.1%), North Macedonia (93.9 %), Bosnia and Herzegovina (93.9 %) and Serbia (93.3 %). Among Western Balkans, there was an increase in the number of tertiary students only in Kosovo and Serbia. At the same time, an average decrease was recorded in Bosnia and Herzegovina, Albania, Montenegro and North Macedonia.

I am pleased to report that we have already adopted 140 qualification standards. One of the interesting qualifications we have been working on is for an electrical technician of renewable energy sources. I want to let you know that we have developed a qualification standard for this field, which may be you based on the topics we have discussed. In the sectoral council for industrial development and in the energy field, there is a plan to modernize and establish standards for qualifications that are currently lacking. This effort aims to improve the entire sector.

Key Informant Interview

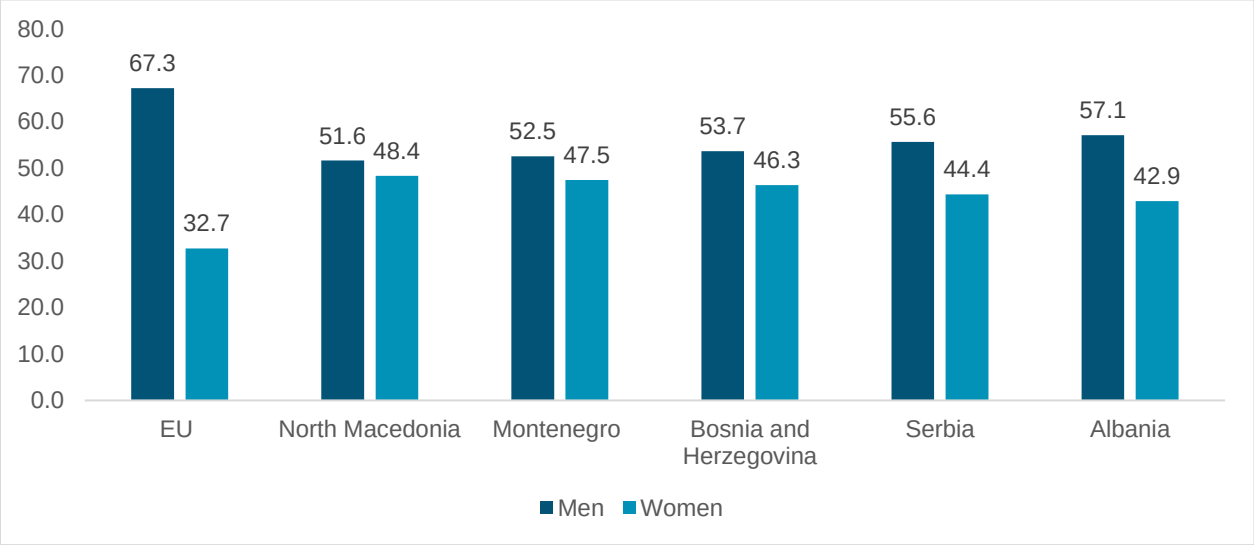
Some of these changes in student numbers may reflect demographic developments (e.g. a growing number of young people in countries characterised by relatively high birth rates or an overall decline in the number of young people in those countries with declining rates) rather than changes in the uptake of tertiary education among young people[39]. For the renewable energy sector, this suggests that although there is a strong base of educated young people, the future labor market may encounter challenges if participation in tertiary education, especially in fields related to renewable energy technologies, does not increase. As the sector requires highly specialized skills, efforts must be made to encourage more young people to pursue higher education and training in relevant disciplines. Additionally, addressing demographic challenges

[39] Eurostat database

through policies that retain and attract young talent will be crucial for ensuring a sustainable and skilled labour force for the renewable energy industry in the Western Balkans.

Figure 19 shows a notable difference between men and women among tertiary education graduates in science and technology. In all countries, men consistently outnumber women in these disciplines.

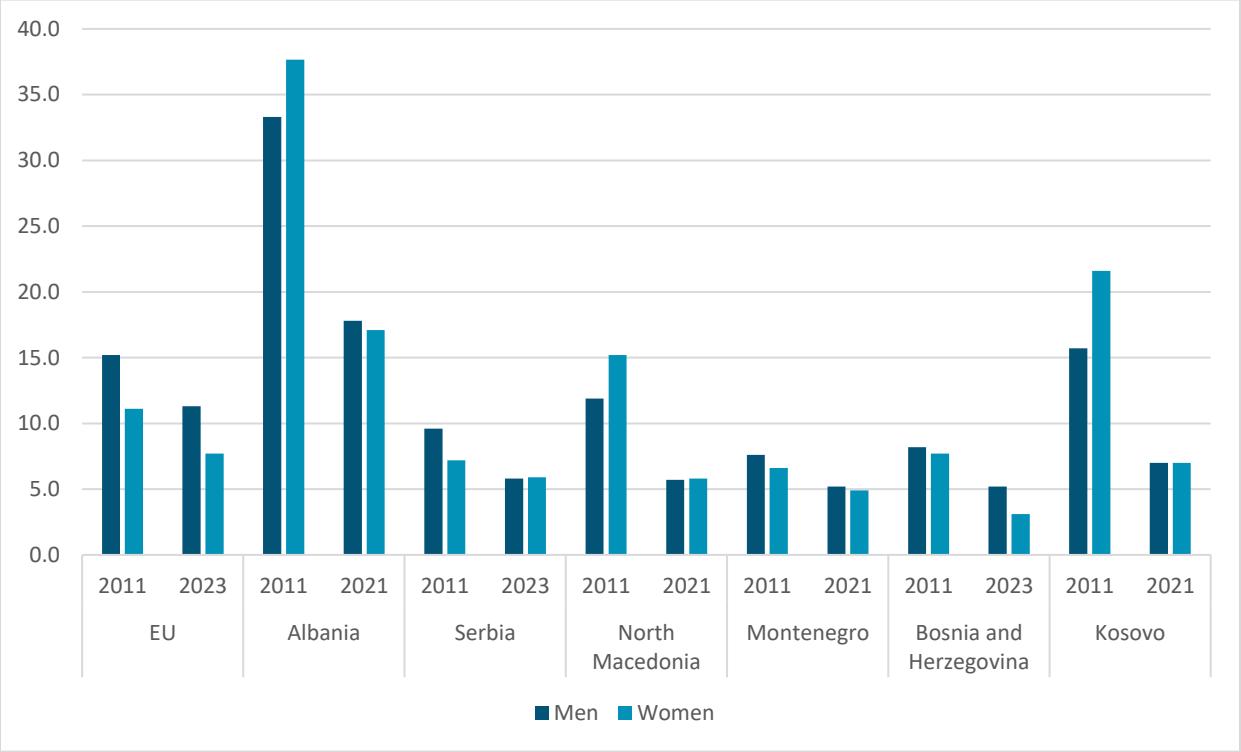
Figure 19. Tertiary education graduates in science and technology by gender, 2021



Source: Eurostat database

There is also a high proportion of early leavers from education and training among persons aged 18-24, which is regularly the highest in Albania (Figure 20). The large number of early leavers from education and training could hinder the transition to renewable energy by negatively affecting workforce development, economic growth, and innovation potential—key elements for advancing renewable energy technologies.

Figure 20. ***Early leavers from education and training among persons aged 18-24 years by gender, 2011 and latest available year***



Source: OECD (2024)

Skills

Skills mismatches are a significant issue not only in WB, but the entire EU, with employers frequently reporting difficulties in finding candidates with the technical and soft skills required by the market. This is particularly evident in emerging sectors such as digitalisation and renewable

> *Only 11 students enrolled in the VET school in Podgorica, and maybe 1-2 will enroll in university. Education is not systemically regulated. Education is desperate. It makes children incapable of working and knowing nothing. We have formally all the right occupation titles for the renewable sector in the education system, and we have standardized professions. Everything is fine programmatically, but we do not have anyone to train. We do not have children.*
>
> ***Key Informant Interview***

energy, where the demand for specialized skills is rapidly increasing. The interviewed key informants (KIs) argue that the education system fails to prepare students for the workforce, leading to a mismatch between the skills of workers and the jobs available in labor markets.

The education system is expected to respond to these new developments adequately. According to the key informant from Serbia, the green agenda and all three basic green competency models are built into each of the qualification standards.

So, all these technical faculties take complete care of all renewable energy sources: wind, water, wind generators, mini hydroelectric power plants, hydroelectric power plants, and solar energy. Everyone is racing to see who will do a better project using solar energy, biogas, and thermal energy.

Key Informant Interview

The Institute for Education Advancement creates the program for pre-university education and the Institute is obliged to respect all these standards and to incorporate subjects related to it. Also, all publicly recognized adult education providers must comply with the entire standard, part of the standard, or some competence when creating the program, or they must incorporate mandatory green competencies. As far as university education is concerned, the university has started to work on the standard of higher education.

They say, "Let's create a new qualification standard for 0an electrical technician of renewable energy – the one who knows the basics of an electrician job needs 10 minutes to learn how to set up a panel. I'm in favor of an open curriculum. The current one can't survive with new technologies that are constantly changing. How do you use your new knowledge? We are coming to keep teachers in their comfort zone with old preparations. When it has a certain palette, something is done. I can work like that, but I say how it should be done. … Let's talk about the fact that through all subjects, through the curriculum, we talk about the green agenda. We should raise awareness from the preschool level. From the first grade onwards, we teach our children to accept the essentials, not the formal ones.

Key Informant Interview

Still, the university's autonomy and the faculties' autonomy allow them to define programs independently according to their needs. However, all of them are obligatory and respect this basic part of the standard. The current education systems often prioritise teaching established knowledge instead of equipping students with the skills they need to succeed in uncertain futures. This approach can inadvertently perpetuate harmful practices that exacerbate inequality and damage the environment, going against sustainability goals. Efforts to implement necessary changes are often slow and do not effectively nurture essential skills. While there are positive initiatives, many remain fragmented and are primarily driven by donors, civil society, ambitious providers, and the private sector, with governments playing a more limited role. These initiatives often suffer from insufficient funding and a lack of coordination across different education levels. This fragmented approach hampers comprehensive skills development.[40]

The VET plays a key role in preparing workers for the labour market. In the context of climate change and energy transition, it is more important than ever for VET to adapt to the changing

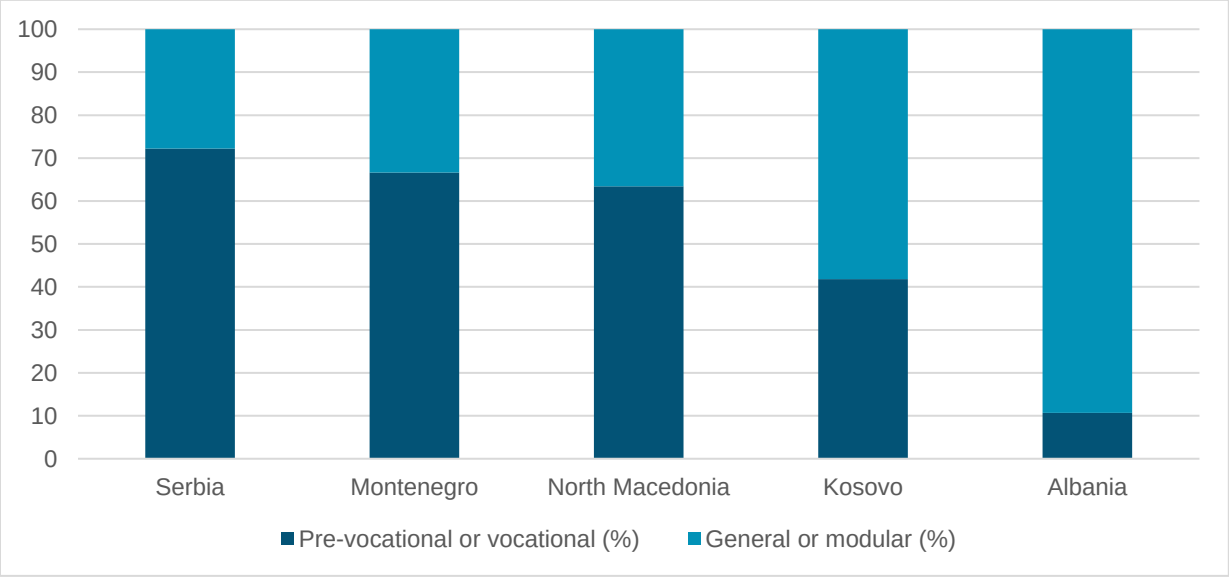
[40]UNICEF (2023). A Gender Mapping of the Green Economic Transition in Europe and Central Asia. Available under https://www.unicef.org/eca/media/33571/file/A%20Gender%20Mapping%20of%20the%20Green%20Economic%20Transition%20.pdf

needs of the RES sector[41]. According to KIs, initiatives are already integrating “green skills” into the VET system and across different occupations.

> *Over the years, since 2020 every standard of qualification has some part of “green” skills in it. from the first generation will hit the market at the end of 2025.*
>
> ***Key Informant Interview***

Improvement of VET governance is especially crucial in the WB, given the high enrolment rates and the need for these systems to provide occupation-specific skills in rapidly growing sectors. Furthermore, it can help reduce previously described high NEET rates by motivating young people to continue their education or training while acquiring valuable skills. Enrolling in VET programs is a popular choice among WB students, with the region reporting a much higher enrolment rate in VET programs compared to the OECD average. At age 15, more than 50% of students in the WB economies are enrolled in pre-vocational or vocational programs, in contrast to the OECD average of 13% (see Figure 21). However, while these high enrolment rates indicate that VET programs are attractive, for most countries, VET is not the preferred choice for education or training but rather a secondary option.

Figure 1 ***VET enrolment in the WB economies (2022)***



Source: Own compilation based on OECD (2024, p.92)

[41] See CETEOR internal handbook "Bridging VET Provision and the Green Business Sector"

Dual Education

The introduction of dual education is at different stages in the WB countries. Serbia has adopted the Law on Dual Education with the accompanying bylaws. From the academic year 2019/20, dual education has been offered as an optional pathway within the formal secondary vocational education system. The dual education model in Serbia currently involves 7,000 students in 37 educational profiles.[42]

When speaking with companies, they claim that practical classes are available, but parents are not supportive.

Key Informant Interview

Dual education has been trying to gain traction for a long time; GIZ has been working on this. There are many challenges for companies working with children, but we must find a solution. We ca say that system exists.

Key Informant Interview

Dual profiles allocate at least 20% and 80% of the total hours for vocational subjects to work-based learning. Each curriculum defines the outcomes of vocational practice in detail, but there is some flexibility to adapt this to the needs of employers. However, some KIs are of opinion that the system is underdeveloped with limited scope. In most VET schools, a professional practice coordinator in companies facilitates coordination between learning venues. This role is in addition to the coordinator for practical learning in school workshops. Contracts in dual education are signed between vocational schools and companies and between learners/parents and companies. In dual education, learners have the status of students rather than employees, but they receive financial compensation of at least 70% of the minimum wage.[43]

According to KI, in BiH, companies are stating that they are interested in providing dual education to students, but students, or more precisely, their parents, are not interested. KIs believe that dual education is a solution for integrating theoretical and practical knowledge, which employers identify as one of the main deficiencies, especially in secondary schools and higher education. The large companies showed interest and are cooperating with secondary schools, through which they are offering employment to the students. This year, the Foreign Trade Chamber invited schools and three companies to cooperate to integrate theoretical and practical knowledge.

[42] Successful Implementation of the Dual Education Model in Serbia - RCF (rcf-wb6.org)
[43] Ibid

We have good results because it is a process that we started in 2007 to first talk about it and then slowly to prepare everything. To adapt the programs to the company's needs, we were able to move forward in 2017. At first, we had three companies that took students and when they finished, they took them to work. We now have 360 companies involved in dual education. we don't have a classic like Germany, we have our national, the company itself has certain criteria. Institutions must develop programs according to the needs of the company. There's a lot of talk about dual education.

Key Informant Interview

In the Republic of North Macedonia, during the 2021/2022 school year, 86 new classes with a dual training component were established. Additionally, 34 programs for practical education were revised, with 1,384 students enrolled across 44 schools. Over 350 VET teachers and approximately 900 mentors from 500 companies received training. As a result of growing interest from businesses, the number of classes featuring a dual training component increased to 225 in the 2022/2023 school year.[44]

The dual education system in Montenegro, introduced in the 2017/18 academic year, operates by the Law on Vocational Education. The rights and responsibilities of both students and employers are outlined in an individual education contract signed by the students' parents, employers, and the school. A cost-sharing mechanism between the government and employers guarantees that students receive compensation for their work during the three years of the program. The VET Centre is responsible for accrediting companies involved in dual education.[45] According to KIs, although the system is formally in place, it is implemented at a low scale and does not involve the renewable energy sector.

We have system of dual education, but not massively. No one in the energy sector is involved in that. The big companies who should carry the system are not in it, and the small companies can't do it. We in Montenegro are shutting down producers,, we have become a country of services and not production.

Key Informant Interview

Adult Education System

Lifelong learning or adult education programs aim to provide adults with vocational retraining, digital literacy, and soft skills to stay competitive in evolving labor markets. The key purpose of the lifelong learning systems in the Western Balkans is to address skills mismatches in the labour market. New developments, such as new technologies and practices in the renewable energy sector, demand new skills not covered by formal education systems. Western Balkan countries are aligning their lifelong learning policies with EU frameworks like the European Education Area and Agenda for Adult Learning.

For instance, Serbia has adopted its Strategy for Development of Adult Education to broaden access to lifelong learning opportunities. Serbia has made significant progress by aligning its adult

[44] Country Fiche_North Macedonia_2022_EN_web_0.pdf (europa.eu)
[45] Montenegro: dual education coming to life! | ETF (europa.eu)

education system with EU standards. The National Qualifications Framework (NQF) was developed to recognize skills and qualifications gained through formal, non-formal, and informal learning.

We have made every effort to make all opportunities accessible to everyone, whether a company, institution, or school. Anyone who wants to initiate a request to innovate or introduce a new qualification focusing on green skills can do so. All channels and procedures are open to them. The extent to which our economy is prepared to transition to these new technologies and the resources available to each individual will determine their success.

Key Informant Interview

The document "Principles and Standards in the Field of Adult Education in Bosnia and Herzegovina" was drafted in the EU project "Strengthening the Capacity for Human Resources Development in BiH." BiH faces challenges due to its highly decentralized education system, with lifelong learning policies varying between entities. However, efforts are being made to harmonize policies and promote adult education nationwide.

Montenegro has adopted the Strategy for Adult Education in Montenegro 2015-2025, elaborating on the principles laid down by the Law on Adult Education.[46]

Albania does not have a specific lifelong learning policy.[47] Albania focuses on improving access to adult learning, particularly in rural areas, through community-based education programs and partnerships with international donors. The National Strategy on Employment and Skills 2023-2030 outlines elements of lifelong learning, with a special focus on expanding vocational education and training for adults in remote areas. It also aims to improve adult learning programs to better align with the labor market's needs and create more inclusive forms of adult learning. The National Agency for Vocational Education, Training and Qualifications has been designated as the National Support Service for the European Platform of Adult Learning in Europe (EPALE).

Kosovo's main policy document is the Education Strategy 2022-2026.[48] The Adult Learning Division of the Ministry for Education, Technology and Science administers the lifelong learning system.

Adult education issues in the Republic of North Macedonia are regulated by the Law on Adult Education and the Law on Open Civic Universities for Lifelong Learning. The government of the Republic of North Macedonia adopted the Strategy for Adult Education in 2010. This strategy is based on the lifelong learning concept and forms the basis of the general education system. Some of the strategy's goals include developing education and training opportunities that effectively respond to dynamic changes in the labor market and workforce needs and linking learning and work efficiently. Adult education is an integral part of the education system. The Adult Education

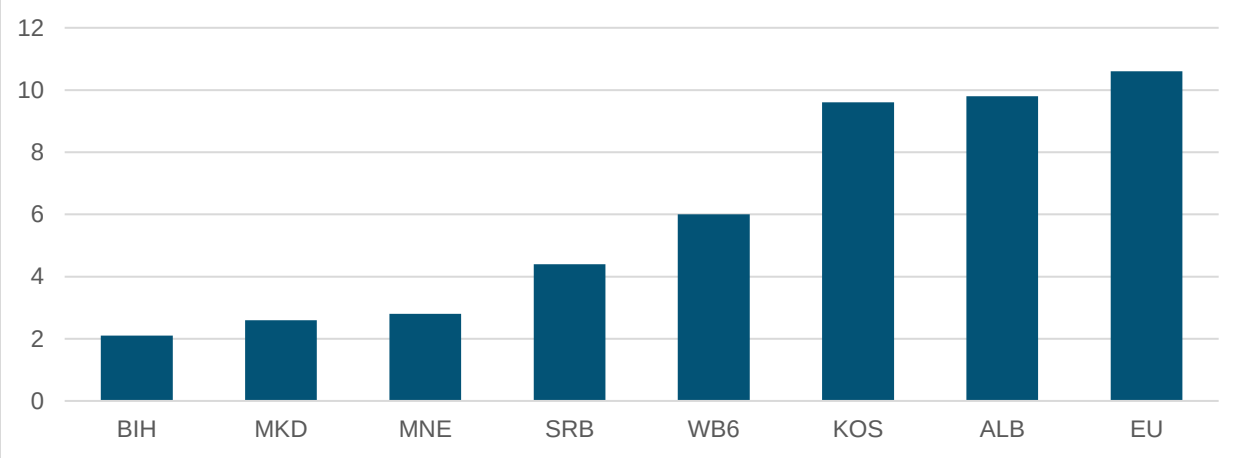
[46] Zakon o obrazovanju odraslih (www.gov.me)
[47] Lifelong learning strategy (europa.eu)
[48] 03-Strategja-e-Arsimit-2022-2026-Eng-Web.pdf (rks-gov.net)

Centre (AEC) plays a crucial role in developing the national adult education system. It was established by the government in November 2008 and began operating in June 2009. Its main responsibilities include promoting adult education, coordinating with international institutions and other adult education organizations, and ensuring quality through the establishment of standards and criteria for both formal and non-formal adult education.

Participation in lifelong learning in the Western Balkans remains relatively low compared to the EU average. According to Eurostat, participation rates in adult learning (aged 25-64) were around 2-4% in Western Balkan countries in 2021, while the EU average was 11.1%. Factors such as limited awareness, low investment, and inadequate infrastructure in rural areas contribute to these lower rates. Many adults may not participate in learning programs due to the cost. Offering free or subsidized courses, especially for unemployed and low-income individuals, can significantly improve participation rates.

As the WB economies embark on the energy and digital transitions (the so-called twin transition), their skills systems must anticipate future skills needs. This includes establishing proper education and training infrastructure for developing and adapting skills that enable and sustain these transitions. [49] The picture of participation in lifelong learning (Figure 22), along with the above-presented lags in education outcomes on all levels, presents a significant obstacle to developing students' skills for the transition towards renewables.

Figure 22. ***Participation in lifelong learning (2018-22)***



Source: OECD, 2024

The existing research shows that although WB countries have committed to ambitious energy transition goals in line with Green Agenda and EU climate targets, they often often fall short in adequately addressing the necessary skills development. They frequently fail to recognize the need for a qualified workforce and do not outline sufficient measures for providing essential skills and competencies to drive a renewable-based energy transition in the Western Balkans region

[49] OECD (2024), Western Balkans Competitiveness Outlook 2024: Regional Profile, Competitiveness and Private Sector Development, OECD Publishing, Paris, https://doi.org/10.1787/170b0e53-en.

[50]. At present, no WB country has a finalised national framework that details the skills required for the energy transition for students. This limits the ability of governmental institutions and other stakeholders dealing with the energy labour market to determine whether the workforce entering the energy sector is effectively acquiring competencies related to renewable energy, especially given the relatively recent introduction of many educational initiatives[51]. In order to address these challenges, it is essential for Western Balkan countries to invest in updating and expanding their educational and vocational training programs.

A crucial aspect of supporting the development of the renewables sector labour market is conducting studies to identify the skills and jobs most relevant for the energy transition, as these assessments can reveal new occupational profiles as new jobs emerge. They can also determine which skills might be transferable from one sector or occupation to another. According to OECD only Albania and Montenegro have embarked on such studies.[5253] (. Across the WB region, for example, countries are integrating climate-related education aspects into their existing curricula.

We need experts to develop a methodology for creating vocational education standards. We are focused on integrating skills and knowledge, and we feel that higher education has been overlooked. Enhancing our ability to incorporate sustainability into higher education is crucial. If you agree that this is important, then we believe that higher education is also important.

Key Informant Interview

Vocational Education and Training (VET) faces several challenges about deploying skills and knowledge development program or occupations to drive the renewable-based energy transition. According to KIs, one issue is the absence of qualified experts to assist in the development of qualification standards. The largest refers to the need to adapt to the transition, which will affect all sectors and professions in a transversal manner, with the emergence of new skills. This means that vocational training must be prepared to deal with the changes introduced, implementing training programmes that meet the needs of companies. It is important to identify emerging professions with strong prospects, such as renewable energy engineers and solar energy technicians, to address the mismatch between skills demand and supply in the renewable energy sector. This can be achieved by creating specialized job portals for renewable energy positions, which will help job seekers find relevant opportunities, and by conducting skills assessments that match job seekers with renewable energy jobs that require specific competencies, such as solar panel installation or wind turbine maintenance[54]There is a lack of cooperation framework or platform in the Western Balkans between the energy (private and public) sector as employers and

[50] Rosso, F. (2024). The future of work in the green transition
Evidence from ETF research in countries neighbouring the European Union . Available under: https://www.etf.europa.eu/en/green2024-futureofskills
[51] For details see OECD (2024), Western Balkans Competitiveness Outlook 2024: Regional Profile, Competitiveness and Private Sector Development, OECD Publishing, Paris, https://doi.org/10.1787/170b0e53-en.
[52] Albania's employment agencies are developing a study on green jobs. At the same time, Montenegro's Chamber of Commerce has begun forecasting the impact of the green transition on employment and identifying and categorising related occupations.
[53] OECD, Western Balkans Competitiveness Data Hub
[54] CETEOR internal handbook on "Bridging VET Provision and the Green Business Sector"

the education sector. This affects the adequate development of the labour market for a RES transition. In terms of skills, this would enhance the matching between supply and demand.

Labor market assessments on renewable energy are not performed regularly or at all. This leads to non-updated skills or labour development programs, including VET curricula on renewable energy.

When talking to employers, they tell you that the unemployed labour force registered at the employment service is not what they need, either because of their age or because they are only formally registered as unemployed and work in the informal sector.

Key Informant Interview

Finally, as the RES sector grows, a shift in the demand from traditional energy sector jobs to new roles requiring advanced technical and digital skills is expected. Skills such as renewable energy technology installation, maintenance, and management, as well as knowledge of energy efficiency, are becoming increasingly important. The WB have a large untapped potential among a large share of NEET youth, unemployed women and individuals working in the informal sector. First, the large share of NEET youth represents a reservoir of human capital that can be developed through targeted activation, training and education programs focused on renewable energy skills. These programs can be designed to equip young people with the technical knowledge and practical skills required for jobs in the RES sector, such as solar panel installation, wind turbine maintenance, and energy efficiency auditing. Encouraging women to pursue roles in renewable energy consulting, installation services, or community-based energy projects can drive local economic development and contribute to the broader energy transition. Finally, many individuals employed in the informal sector possess skills that are applicable to the renewable energy sources sector, such as basic electrical work or construction. Creating enabling conditions for these workers to transition into formal employment within the RES sector can decrease informal employment rates and expand the labour pool available for renewable energy projects. However, not all unemployed individuals registered with employment services are available for work. According to key informants (KIs) interviewed, employers have provided negative feedback regarding their experiences with finding workers through employment services.

5 Renewables sector and infrastructure conditions

Decarbonisation of the electricity sector requires significant infrastructure investments. This includes investments in generation capacities and modernizing the grid. Climate change mitigation by lowering greenhouse gas emissions, air pollution from fossil fuel burning, a cleaner environment, and improved public health outcomes are all advantages of investing in renewable energy for society. This is particularly relevant for Western Balkan (WB) countries that generate most of their electricity from lignite (i.e. all WB countries except Albania), which contributes to the highest levels of air pollution in Europe. Economically, renewable energy projects create new jobs in manufacturing, installation and maintenance, contributing to local and national economic growth. Moreover, renewable energy sources like wind and solar are increasingly cost-competitive, offering long-term price stability for the industry compared to volatile import electricity prices.

As most of the WB countries are a net importer of electricity (the exception being Bosnia and Herzegovina), renewables might increase energy security and contribute to the competitiveness of their economies. It is questionable, however, whether sufficient institutional, financial and human capacities are available for successful decarbonization of the electricity sector in the Western Balkans countries by 2050, in line with the 2020 Sofia Declaration on the Green Agenda and the Decarbonisation Roadmap for the Contracting Parties of the Energy Community.

Currently, the region's electricity networks face significant barriers to the deployment and integration of renewables. This includes technical barriers (capacity constraints of grid infrastructure, lack of flexibility and demand response and lack of technical capacities and skills to manage the variability of renewable energy and balancing supply and demand), economic barriers (capital costs for generation facilities and grid upgrades, market structure, inadequate investment incentives), regulatory and policy barriers (such as lack of consistent and long-term policies supporting renewable energy that create certainty for investors, complex environmental approvals, permitting and land use, subsidies for fossil fuels) and social barriers (public opposition, lack of skilled workers, lack of social programs for workers in fossil-based industries, energy poverty). [55]

Despite significant progress in recent years, the renewable generation capacities in WB still need improvement. The main non-hydro emerging resources are primarily wind parks (see Table 7). Serbia has the largest capacity of wind farms, 646 MW (6% of total installed capacity), followed by Kosovo (136 MW, 9% of total installed capacity), Bosnia and Herzegovina (135 MW, 3% of total installed capacity), and Montenegro (118 MW, 12% of total installed capacity).

Solar PV developments are still at an early stage, with some improvements in recent years. While generally shares of PV are below 1% of installed capacity, in 2024 in Albania 195 MW (8% of total installed capacity) became operational, and 30 MW was added in Bosnia and Herzegovina and 26MW (reaching total of 29 MW) in Serbia (ENTSOE, 2024).

[55] For more details see OECD (2024).

Table 5 Installed capacity 2024, MW and % of total installed capacity

	Kosovo*	Montenegro*	North Macedonia	Serbia	Albania	Bosnia and Herzegovina
Fossil Brown coal/Lignite	1288	210	824	6011	0	1883
Fossil Gas	n/e	n/e	251	607	0	N/A
Fossil Hard coal	n/e	n/e	n/e	n/e	0	N/A
Fossil Oil	n/e	n/e	165	n/e	97	N/A
Fossil Oil shale	n/e	n/e	n/e	n/e	0	N/A
Hydro Pumped Storage	n/e	n/e	n/e	642	0	440
Hydro Run-of-river and poundage	33	307	n/e	2053	527	252
Hydro Water Reservoir	35	342	644	484	1676	1456
Solar**	n/e	n/e	22	29	195	30
Wind Onshore	136	118	37	646	0	135
Total Grand capacity	1492	977	1928	10541	2495	4196
Fossil-based generation	86%	21%	64%	63%	4%	45%
Hydro	5%	66%	33%	30%	88%	51%
Solar			1%	0,28 %	8%	
Waste				0,30 %		1%
Wind	9%	12%	2%	6%		3%

**Latest available data for Kosovo and Montenegro are for 2023;*
*** The data refer to market-sized, large power plants connected to the transmission network listed in official documents*

Altogether, new RES capacities exceed 10% of the total installed capacity only in Montenegro (118 MW, Table 7). The barriers to RES development include the high cost of capital and need for subsidies; ageing transmission and grid infrastructure that struggles to cope with large variable RES energy volumes; slow and unpredictable planning processes; regulatory uncertainty; underdeveloped day-ahead and intraday markets; and limited regional market integration. Direct and indirect subsidies to coal-based generation increase the relative prices of RE and make it less competitive. [56]

Despite investments in renewable generation and grids in recent years, challenges related to outdated infrastructure and insufficient investment persist. Enhancing grid capacity and integrating innovative technologies are crucial for the sector's growth. This requires additional enhanced solutions to remove barriers (technical, economic, regulatory and policy, social). Political will and institutional capacity are preconditions for removing barriers, developing technical skills, financing models, and a supportive regulatory and policy environment. Raising

[56] For more details see Miljević (2020)

general awareness and public acceptance are also necessary for a successful transition.[57]

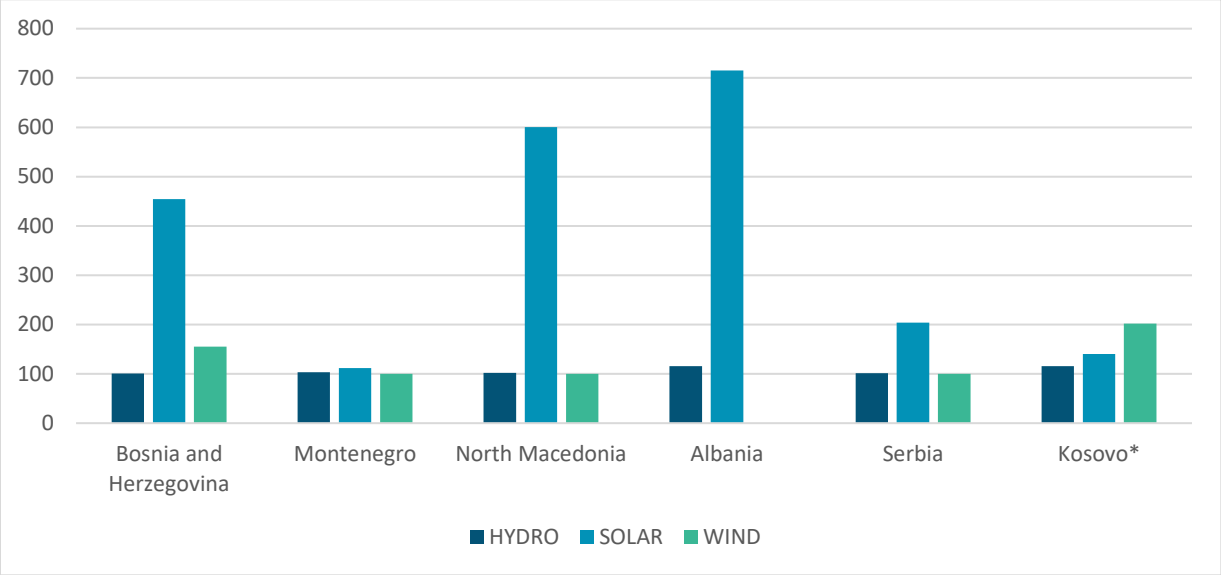
In general, companies have issues finding employees, and they are satisfied if the employees have basic skills and knowledge, which can be upgraded through on-the-job training.
There is the electro technician for renewable sources of energy vocational profile, which requires a four-year education. However, there was no particular interest in that.
A solar panel assembler position was also mentioned, but it was not accepted because we were told that a network systems electro-assembler could perform that job. The education system does not want to have too many different job profiles.
There is also a university-level education program called Energy Efficiency and Pure Energy.

Key Informant Interview

From 2019 to 2022, the growth of generation capacities in solar PV will be the fastest in all WB countries except Kosovo (Figure 23). The initial solar capacities were rather low; thus, despite multiple increases, the installed wind capacities still exceed solar capacities in all WB countries except Albania (Table 7). The availability of qualified installers might become a critical emerging bottleneck for further sector growth. Solarization plans and accompanying training programs should consider the proportion between utility-scale and roof-top projects. For utility-scale projects, design engineers are particularly essential. **Reasons include the number of STEM students decreasing faster than observed depopulation and fierce competition for engineering talents. Thus, the sector is affected by brain drain.** For rooftop PV systems, electrical engineers are crucial for the appropriate design and the safe grid connection of the solar system. The lack of roofers and construction workers slows down the development of the rooftop PV market and the utility-scale market.

[57]Protests in Belgrade in August 2024 to stop Rio Tinto's planned lithium underground mining and processing operations in Jadar region illustrate how the lack of institutional credibility can create barriers for investment projects.

Figure 2 Increase of generation capacity for renewables in 2022 (2019=100)



Source: Eurostat

Generation of electricity from renewables creates direct renewable electricity jobs, which are directly associated with RE technologies. Indirect jobs are those involved in supplying the renewable energy industry. Examples might include labour required to extract and process raw materials (e.g. steel for wind turbines), positions in ministries, regulatory bodies or consultancies working on issues related to renewables. The number of indirect jobs depends on the structure of the whole power sector (its value chain). For instance, grid operators in Albania (which is almost 100% based on hydropower) can be considered as indirect renewable jobs. In comparison, grid operators in Kosovo (where 86 % of generation capacities are based on fossil fuels) or in North Macedonia and Serbia (where 64% and 63% of generation capacities are fossil fuel based, respectively, Table 7) cannot be considered as renewable jobs. The expansion of renewables also requires a change in the employment structure (shown in Figure 21) and new skills to perform existing jobs. Therefore, in addition to quantitative data, projections of renewable job creation should consider necessary skills in performing activities that are affected by technological and non-technological changes.[58]

But the real numbers in terms of the workforce need are very small, and we are in the phase of raising awareness and promoting the renewable energy sector. They do not know whether the general absence of a qualified workforce or the general lack of knowledge about the renewable energy sector among entrepreneurs is causing the absence of demand for specific renewable energy sector professions.

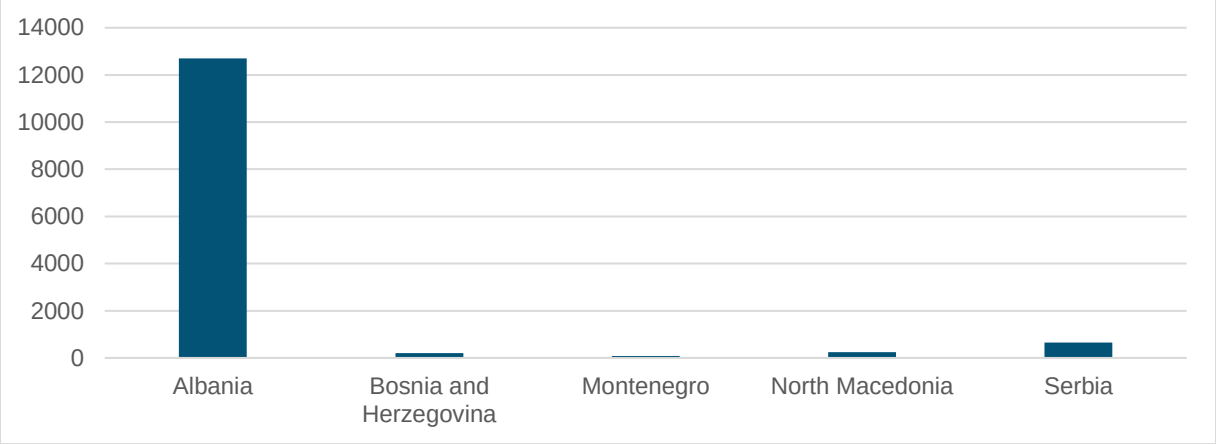
Key Informant Interview

Currently, according to estimates from IRENA and ILO (2024), based on employment factors and

[58] For more see ETF (2022) https://www.etf.europa.eu/sites/default/files/2022-01/fow_albania_energy_sector_final_en.pdf

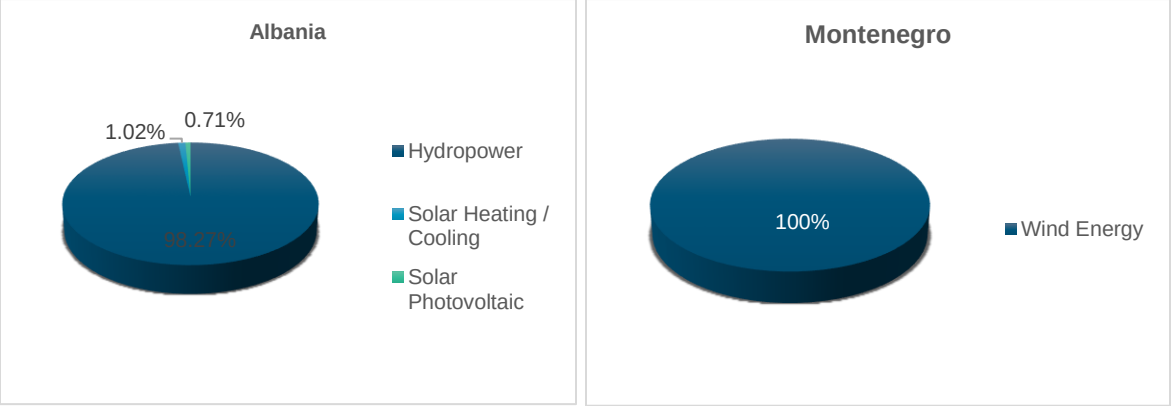
capacity data, most of the RES jobs Western Balkans are in Albania (12,700 jobs, out of which 13,483 are hydro-power related). There are 654 RES jobs in Serbia, 55% of which (359 jobs) related to wind and 45% (295 jobs) related to solar PV. In Northern Macedonia, Albania and Montenegro, the number of renewable jobs could be much higher. Some of the RE is used to produce heat (North Macedonia) and in power sector, RE is in these countries mostly used for solar PV. Key informants have reported that despite a significant increase in production capacities and output, there is a low demand for employees with specialized skills in the renewable sector. Additionally, the formal education system does not appear to be interested in developing and introducing specific education programs for specialized renewable energy professions. This is partly because employers and stakeholders in the education system believe that certain current occupations can meet the job requirements in the production of solar and wind energy. Figure 24 and Figure 25 present the current number and share of RE jobs in WB.

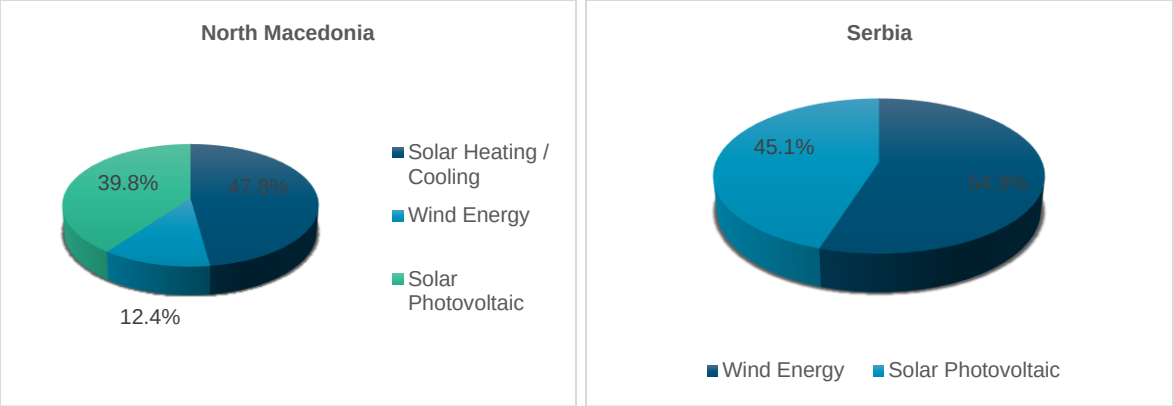
*Figure 24. **Number of employees in the renewables sector (all technologies), data for 2022***



Source: Irena and ILO (2024)

*Figure 25. **Share of employees within specific renewable technology in total employment***





Source: Own calculation by IRENA and ILO (2024) data

6 Jobs projections within renewables sector

One of the most significant co-benefits of implementing renewable energy technology is increased employment. In WB countries, official statistics do not provide data on renewable energy employment.. Thus, the starting point are projections based on employment factors calculated from IRENA and ILO data (Figure 20 and Figure 21, IRENA and ILO, 2024) and IRENA methodology (IRENA; 2011).

Since the input data are rough estimates, , we use three different approaches to ensure the robustness of the results:

- Using regional multipliers
- Calculating employment factors
- Estimating direct and indirect jobs

To estimate the number of jobs needed in the renewables sector every year up to 2030 (t=7) the following approach is used:

$$Projected\ installed\ capacity = Current\ installed\ capacity(MW) \times (1 + annual\ growth\ rate\ R)^t$$

$$annual\ growth\ rate\ R = \left(\frac{Installed\ capacity_{2030}}{Installed\ capacity_{2023}}\right)^{\frac{1}{t}} - 1$$

$$Projected\ number\ of\ jobs = Projected\ installed\ capacity \times Employment\ multiplier$$

Table 7 and Table 8 provide input data (current installed capacity, 2030 installed capacity) for key RE technologies (hydro, solar, and wind). Annual projections for each WB country are presented in Figure 22 below.

The methodology for defining the employment multiplier is based on IRENA (2011) and adopted in line with more recent studies, primarily the GWEC Global Wind Report (Agora Energiewende), NREL Jobs and Economic Development Impacts (CEENERGYNEWS), and EU Solar Jobs report.

Table 7 ***current renewable generation capacity and 2030 targets,***

		Installed capacity 2022	Target 2030
Albania	HYDRO	2493,0	2493,0
	SOLAR	163,0	590,1
	WIND	0,0	300,0
Bih	HYDRO	2258,1	2526,8
	SOLAR	132,0	1492,0
	WIND	135,0	600,0

Serbia	HYDRO	2494,0	2511,0
	SOLAR	137,0	1432,0
	WIND	511,0	744,0
Montenegro	HYDRO	696,7	823,0
	SOLAR	42,0	293,0
	WIND	118,0	190,0
Kosovo	HYDRO	110,1	110,1
	SOLAR	20,0	730,0
	WIND	137,0	670,0
North Macedonia	HYDRO	696,0	1360,3
	SOLAR	535,0	856,5
	WIND	110,0	302,3

Source: Authors, based on NECPs (for 2030 target) and IRENA and ILO (2024) for projections

1st approach – using regional (EU) multipliers

First, we can calculate the total number of jobs that will be generated by 2030 to get a general idea of jobs within each sector, taking into consideration regional multipliers (i.e. for the EU). For this purpose, we need employment multipliers for each sector, calculated as the ratio of jobs in each specific technology divided by the installed capacity to obtain the number of jobs per MW of installed capacity. According to IRENA and ILO 2023 report on jobs in renewables (IRENA and ILO, 2023, p.39)[59] and EU Solar Jobs Report 23[60], the EU employed 648 000 in the solar PV sector at the end of 2022, 83 000 in hydropower and 319 000 in wind power.

Based on this data and IRENA methodology (IRENA, 2011), the multiplier for solar PV is 3.5, for wind 1.6, and for hydro energy 0.5 (see Table 8). The projections based on these multipliers are conservative, as previous studies estimate the employment multiplier for solar PV in the range of 5-10 jobs per MW of installed capacity.

Table 6 : Employment multipliers per different technology (jobs per MW of installed capacity)

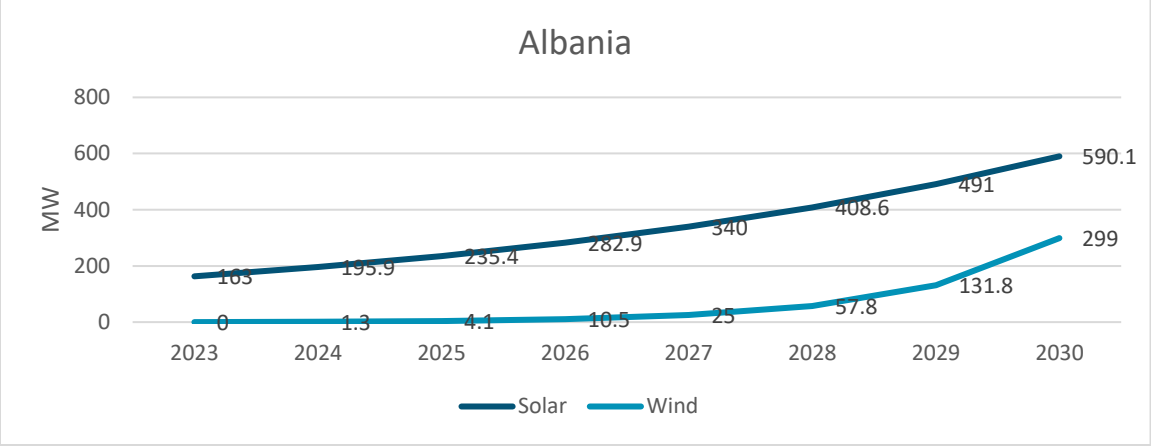
Energy source:	Multiplier
Solar PV	3,5
Wind	1,6
Hydro	0,5

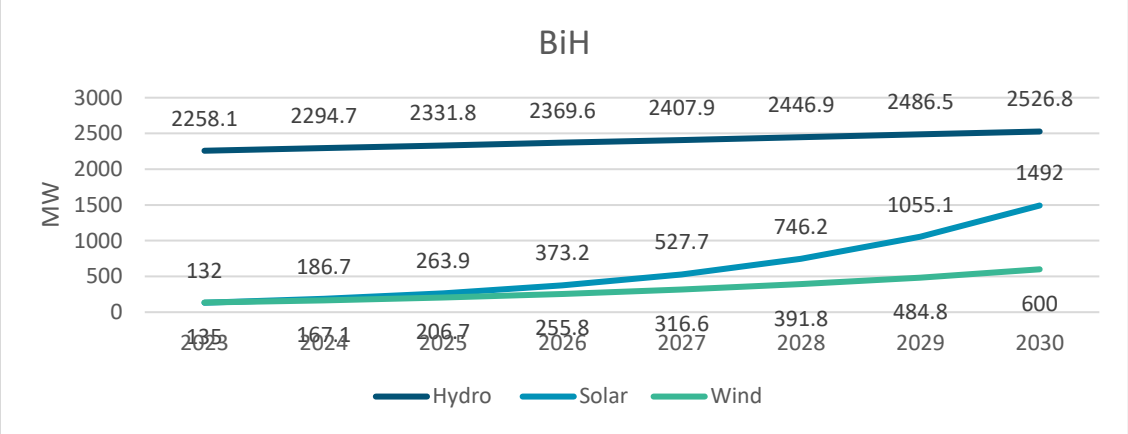
Source: authors, based on IRENA (2011) and IRENA and ILO (2024)

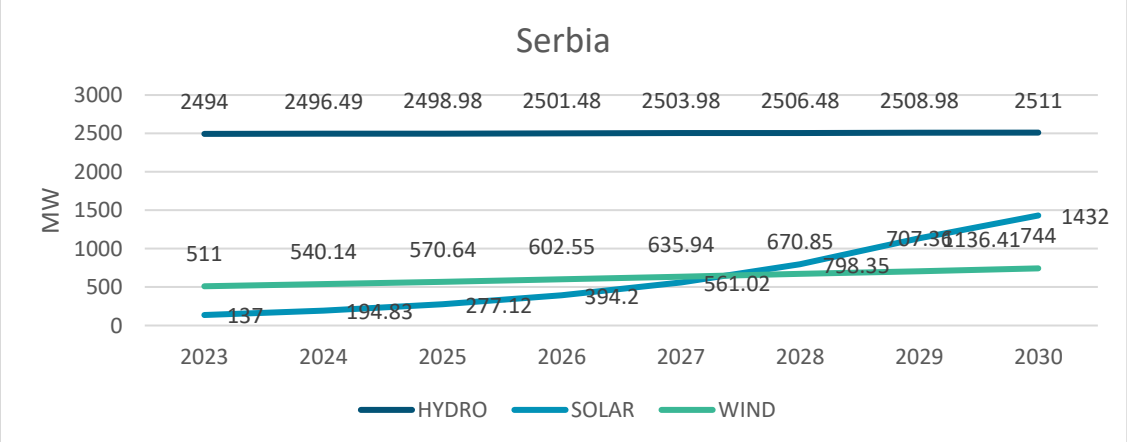
[59] IRENA and ILO (2023), Renewable energy and jobs: Annual review 2023, International Renewable Energy Agency, Abu Dhabi and International Labour Organization, Geneva.
[60] Solar Power Europe (2023). EU Solar Jobs Report 2023. Bridging the solar skills gap through quality and quantity. Available under: https://api.solarpowereurope.org/uploads/1823_SPE_Jobs_report_09_0953d35b2a.pdf?updated_at=2023-09-26T11:44:34.465Z

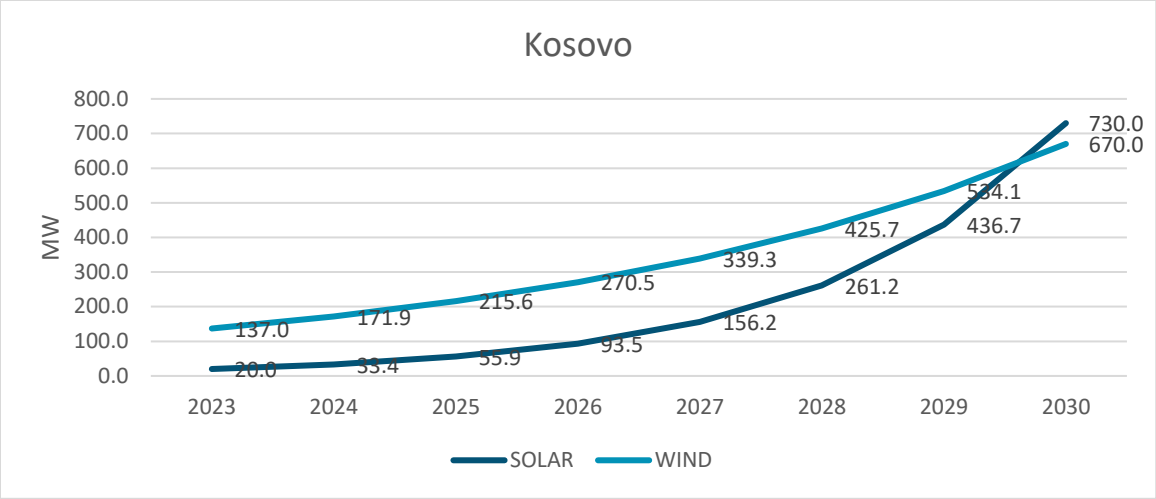
Planned new solar capacities by 2030 are 4365 MW, and wind capacities 1795 MW. Despite the fact that conservative multiplier is used, the solar sector has the largest potential for employment generation.

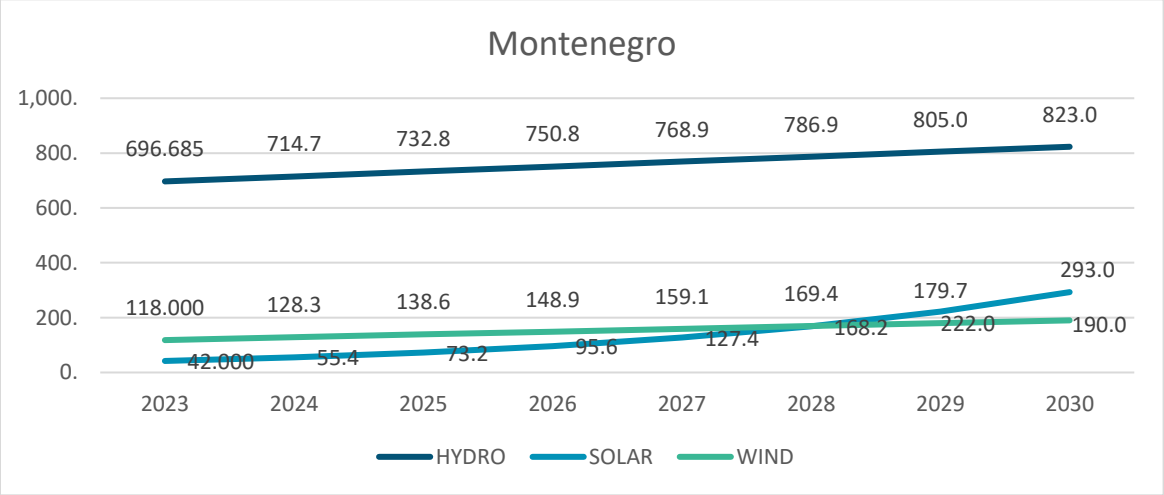
Figure 26. ***Projected installed capacities, on yearly basis, in MW***

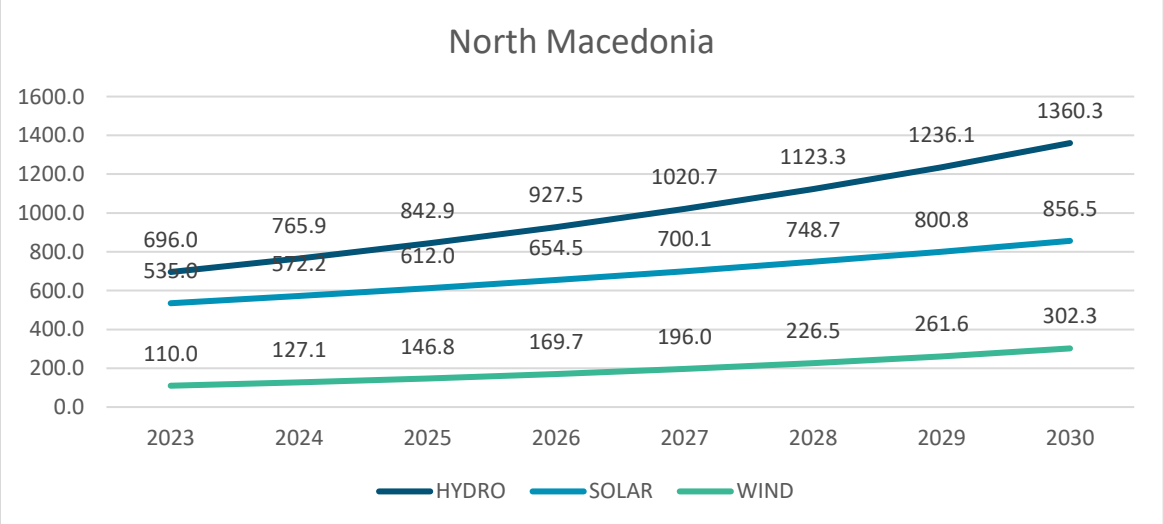












Source: Own calculation based on national projections for 2030

Using the above projections for installed capacities in 2030 and the estimated average employment multipliers, the number of estimated jobs in each sector is provided in Table 9.

*Table 7. **Estimated number of employees up to 2030***

	HYDRO	SOLAR	WIND
Albania	*12483**	2065	480
BiH	1263	5222	960
Serbia	1255	5012	1190
Montenegro	412	1026	304
Kosovo	*55***	2555	1072
North Macedonia	680	2998	484
TOTAL	3665 *,** (16148)	18878	4490

Source: Own calculation;

Note: *Value from 2022 since no expected change in hydropower installed capacity exists; **Kosovo has limited potential for hydropower, and further development of hydropower plants poses risks to the environment. The country's economy has only 2,100 cubic meters of renewable water resources per capita per year, which is equivalent to 13.95% of the Western Balkan average, close to water stress levels.[61]

2nd approach – calculating employment factors by phases (installation, manufacturing and operations and maintenance)

According to IRENA (2020) forecasts, there is plenty of potential to localize renewable energy employment, such that the energy transition contributes to the fortification of domestic supply chains. Generally, manufacturing, the value chain segment most difficult to localise, accounts for 44% of the jobs in the subset of renewable energy technologies, while construction and installation accounts for 38% of jobs and O&M for 18%. Regarding the job structure by skills, 76% of the jobs associated with this subset of renewable energy technologies are held by workers and technicians, while experts account for 11%, engineers and other highly qualified roles make up 8% and marketing and administrative personnel 5% (IRENA; 2020).

The employment factor (EF) approach is used to estimate direct employment associated with energy technologies through the value chain. In the context of this approach, the total direct energy jobs are a sum of jobs in manufacturing, construction and installation and operations and maintenance. Job categories through the value chain are further defined as follows. First, manufacturing jobs involve the number of jobs required to produce a unit of power, heat, storage, or fuel production and processing capacity. The employment in manufacturing is temporary compared to the entire technical lifetime of the installation. However, with scaling and high demand, manufacturing units and associated jobs can last for a long time. This is why they are expressed as job-years, which represents the total number of full-time jobs required for manufacturing over the installation's technical lifetime. Nonetheless, the manufacturing of equipment and components for energy installations may happen outside the region or country where the energy generation, production, or storage capacity is being installed. Many countries

[61] OECD (2022), Multi-dimensional Review of the Western Balkans: From Analysis to Action, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/8824c5db-en.

rely on importing renewable energy technologies as domestic production is insufficient or non-existent, which we will assume is the case for WB countries. Second, construction and installation jobs include all the jobs associated with constructing and installing a power unit. It is assumed that a local workforce will install and construct all energy projects, as is in most cases around the world. These are expressed in terms of job-years, or the total number of full-time jobs needed for the construction and installation over the plant's lifetime. These jobs are predominantly from the planning phase of an energy project (in the first few years) and last during the period in which the energy plants are built until the beginning of operation. In this case, the construction and installation jobs are annualised over the construction period of a power plant, which is the time required for the construction and installation of a unit of energy capacity (per MW). Third, operation and maintenance (O&M) jobs comprise all the jobs associated with operating and maintaining the operational condition of an energy plant over its technical operational lifetime. As energy plants are usually designed to run for decades, operation and maintenance jobs last for a relatively longer duration. They are, therefore, interpreted as jobs per capacity of energy generated, stored, or produced. These jobs are considered for the lifetime of the respective energy plants and are further annualised to get the total number of jobs during the transition period. Installation jobs are based on annual installed capacity, while O&M has a cumulative installed capacity[62]. The capacity factors used were 20% (solar PV), hydro (55%) and wind (35%), while equipment lifetime in years was set to 40 (for hydro), 25 (solar) and 20 (for wind).

The table below provides the main input data for calculating the employment factor for these phases.

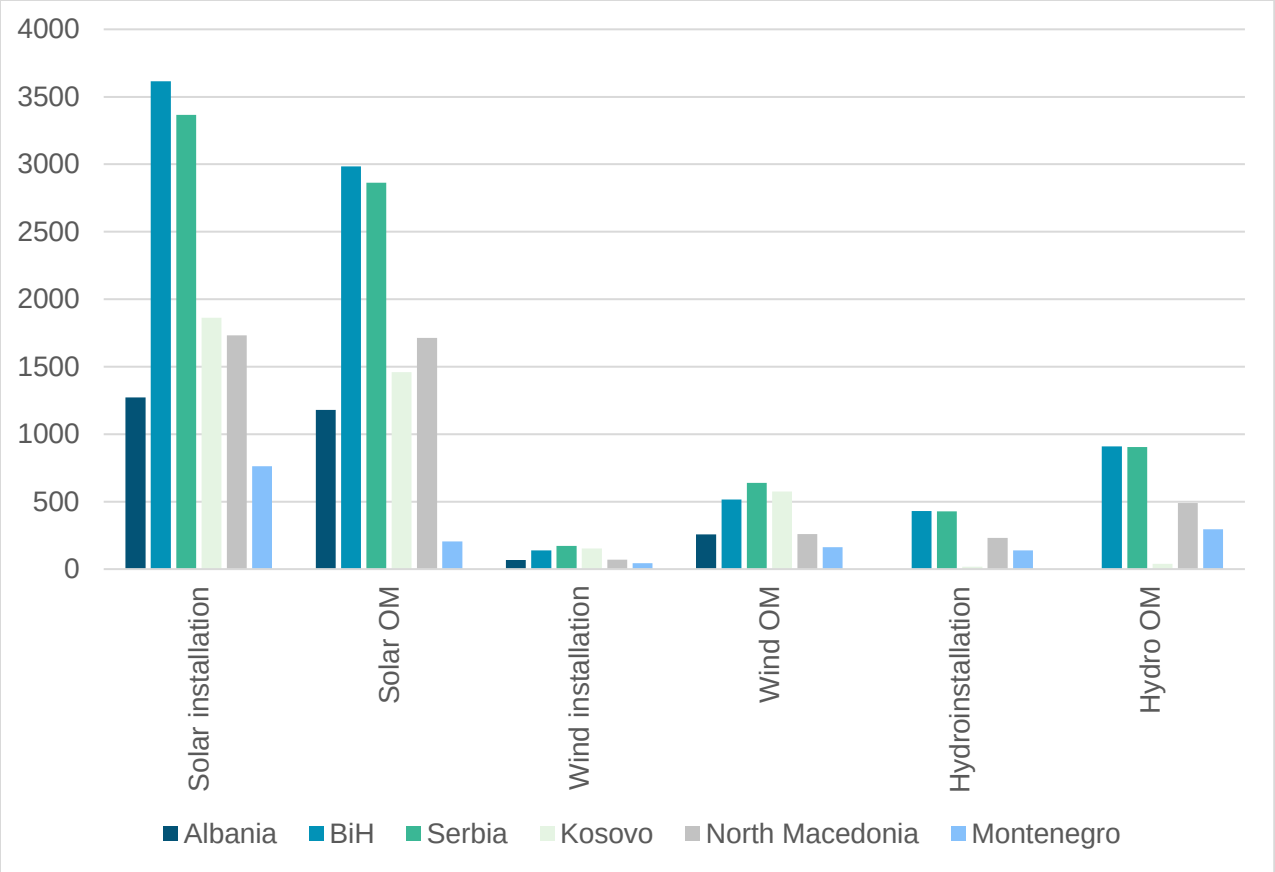
*Table 8. **Job generation by technologies phases***

Technology	Manufacturing EF (Job-yrs/MW_{el})	Construction and Installation EF (Job-yrs/MW_{el})	Operation and Maintenance EF (Jobs/MW_{el}/year)
PV utility-scale	6.70	13.00	0.70
Hydro	3.50	7.40	0.20
Wind	4.70	3.20	0.30

Source: Ram et al. (2022)[63].

*Figure 27. **Projected number of jobs for 2030 by each phase in value chain***

[62] Ram et al. (2022). Job creation during a climate compliant global energy transition across the power, heat, transport and desalination sectors by 2050 (suplementary materials). Available under: https://ars.els-cdn.com/content/image/1-s2.0-S0360544221019381-mmc1.pdf



Source: Own calculation

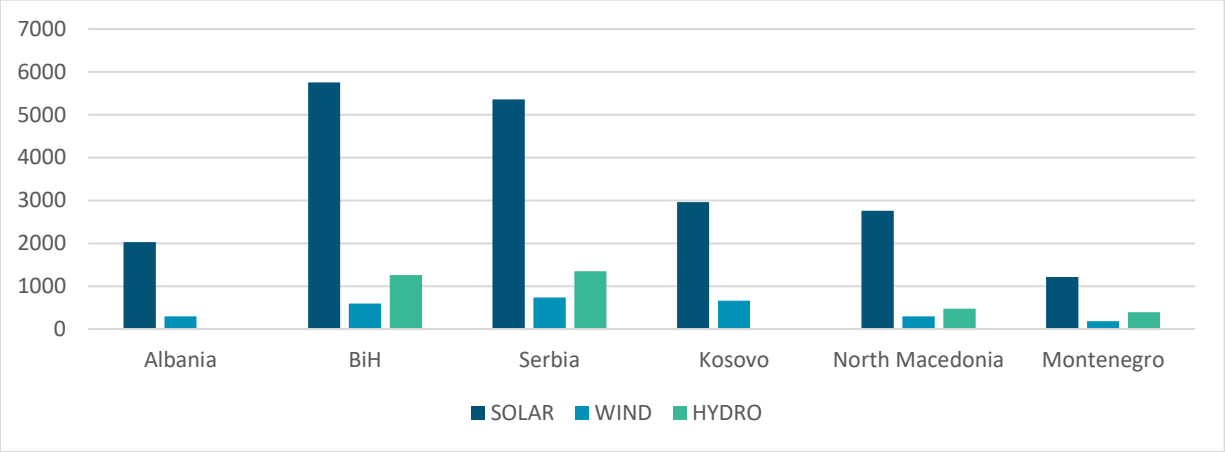
These data again show that the solar PV sector has the largest potential in employment generation. Deployment of PV could positively impact WB countries that record substantial levels of youth unemployment.

3rd approach - direct and indirect jobs

At the EU level, total direct and indirect employment from the renewable sectors is estimated at 1.69 million full-time equivalents by 2022. However, the employment data include both direct (renewable equipment manufacturing, renewable plant construction, engineering and management, operation and maintenance, biomass supply and exploitation) and indirect (transport and other services) employment. Thus, this approach is adopted[64] [65]. The default setting is that indirect multipliers are 90% of the magnitude of the direct multiplier (Kim et al., 2022). The figure below shows the additional number of indirect jobs generated within each sector.

[64] Induced employment is outside the scope of this analysis.
[65] THE STATE OF RENEWABLE ENERGIES IN EUROPE. EurObservER-overview-barometer-2023.pdf

Figure 28. Indirect jobs generated up to 2030



Source: Own calculation

If we consider indirect and direct jobs together, the most significant number of jobs will be generated in the solar sector at the level of WB countries.

Table 9.. Direct + indirect jobs generated up to 2030

	Solar	Wind	Hydro
Albania	4280	625	
BiH	12149	1254	2661
Serbia	11318	1555	2849
Kosovo	6258	1400	
North Macedonia	5825	632	1008
Montenegro	2561	397	835
TOTAL	42391	5863	7353

Source: Own calculation

It should be mentioned that this approach allows for modifications in the methods to capture the dynamic nature of employment creation through the transition years and inclusion of different dimensions of regional trade and labour productivity, implying that the number of direct/indirect jobs has significant uncertainties which depend on the methodology. Ram et al. (2022) estimated the jobs created during the entire energy transition across the power, heat, transport and desalination sectors from 2015 to 2050 in 92 countries/regions of the world, including an area of WB plus Croatia and Slovenia (as one region). For the 2025-30 period, the estimated number of jobs created across the power, heat, transport and desalination sectors amounts to 261 596. For example, we can use this to check our results robustly. According to calculations, at the level of the EU, solar PV represents around 17% of total jobs, and if we apply this distribution to our region, this would amount to around 44 500 jobs.

Considering the results and existing estimates for this region but for all technologies, we can conclude there is evident untapped potential for direct jobs in other sources besides solar PV, hydro, and wind, which were analysed in this paper. Moreover, as the employment level increases

during the global energy transition, the employment structure of the energy sector may shift towards more highly qualified workers, particularly due to the relatively higher level of qualifications required to manage renewable power generation. This means that the energy transition will provide not only more jobs but also better-qualified ones.

Finally, the calculation of induced jobs is out of the scope of our analysis since this depends significantly on the structure of the economy. However, during the construction phase, the number of jobs is comparable to the number of energy efficiency jobs, and using the approximations for energy efficiency in the building sector in Croatia (BPIE, 2020), we could say that for every 20 direct and indirect jobs, 8 induced jobs are generated.

7 Conclusions and recommendations

The electricity mix of Western Balkan countries highly depends on conventional power sources, primarily fossil fuels (Kosovo, Serbia, North Macedonia, Bosnia and Herzegovina, Montenegro) and hydropower (Albania). The electricity mix is not diversified. Despite progress in recent years, renewable capacities (except hydro power in Albania) are limited. Increased deployment of RES creates demand for relevant skills. However, programs and initiatives focused on green jobs in the Western Balkans are still in their early stages, with economies progressing at varying rates. Most of these economies require an all-encompassing policy framework to prepare their workforce to transition to RES jobs. In addition, their current employment and environmental strategies must sufficiently address employability and skills development for the evolving landscape of RES jobs. While Albania, FBiH, and Montenegro are exceptions and recognise the importance of skills for the RES transition, concrete measures do not consistently accompany these acknowledgements.

Investments in RES enable mitigating climate change, improving air quality, creating business opportunities and jobs, and increasing resilience to the fluctuation of import electricity prices. However, adopted RES targets for the period until 2030 could be more ambitious, and there are no plans to phase out coal-based thermal power plants.

The identified barriers to faster decarbonisation of the power sector in the WB are technical, financial, regulatory and policy, and social.

1. Technical barriers relate to:

- **Grid Infrastructure**: Existing power grids were designed for centralized fossil fuel plants and may struggle to integrate decentralized and variable renewable sources like wind and solar.
- **Energy Storage**: Renewables' intermittent nature requires effective energy storage solutions to ensure a stable supply, but current technologies are expensive and not yet widely deployed.
- **Integration Complexity**: Managing the variability of renewable energy and ensuring a balance between supply and demand is complex, requiring advanced grid management systems and real-time data.

2. Financial barriers

- **High Initial Costs**: Although renewable energy can be cost-effective over time, the upfront capital required for generation capacities, grid upgrades, balancing and storage can be prohibitive.
- **Market Structures**: Traditional energy markets may not be well-suited for renewables, often favouring established incumbent utilities. Ownership structure further diminishes incentives for reforms, especially when the government uses energy policies instead of social policies, making it difficult for renewables to compete.

3. Regulatory and Policy Barriers:

- **Inconsistent Policies**: The need for consistent and long-term government policies supporting renewable energy creates uncertainty for investors.
- **Permitting and Land Use**: Obtaining permits for renewable energy projects can be lengthy and complex, mainly when dealing with land use conflicts or environmental concerns.

4. Social:

- **Skills gap:** As the RES sector grows, it is expected a shift of the demand for traditional energy sector jobs to new roles requiring advanced technical and digital skills which are scarce.The key informants (KIs) believe that workers with skills from the renewable energy sector will be increasingly in demand in the labour markets. According to the KIs, the easiest way to address a skill mismatch between the skills of the available workforce and available jobs is for the companies to provide on-the-job training and upskill their existing staff. However, going further and with the advancement of the energy transition, companies will also need new staff. That is the part where the formal education system should step in.

- **Public Opposition**: Renewable energy projects, especially wind farms and large solar arrays, sometimes face opposition from local communities due to concerns over environmental and health impacts.
- **Lack of Awareness**: In some areas, more public understanding and acceptance of renewable energy is still needed, which can slow down deployment efforts.

Overcoming these barriers requires coordinated efforts from governments, private sectors, and communities.

Based on the findings of this study, the following recommendations for policymakers are formulated:

- Formally adopt climate neutrality goals and develop action plans for the phase-out of fossil TPPs
- Improve the regulatory framework that enables the decarbonisation
- Improve the business environment and investment climate
- Develop financial instruments for restructuring (including social protection of workers)
- Encourage inclusion in the formal labour market
- Continue to develop general public awareness about the need to limit emissions and decarbonise power sector
- Anticipate skills needs in the public sector and enable competence reinforcement

Job Loss and Job Creation

During the data collection process, the assessment team identified many concerns about the negative effects of the energy transition. These include potential job losses, challenges in creating new jobs in renewable technologies, and the adverse impact that the decommissioning of traditional thermal power plants (TTPs) may have on the stability of the national electricity network and supply.

The data collected show that approximately 138,000 jobs are associated with coal-related sectors in the WB countries, with *90,000 jobs in the mining industry and 49,000 in coal-based thermal power plants (TPPs*). If coal is phased out, it is estimated that the following percentage of the total workforce may be affected: 0.4% in Montenegro, 0.5% in North Macedonia, 0.6% in Serbia, 1.3% in Bosnia and Herzegovina, and 1.4% in Kosovo.[66] [67]

One of the findings indicates that investing in the renewable energy sector can help Western Balkans countries create jobs, especially in areas with high unemployment, thus contributing to economic growth and increasing employment rates.

The renewable energy sector offers a valuable opportunity to tackle gender gaps in employment. Research shows that renewable energy projects can create a variety of job opportunities, ranging from technical roles in engineering and maintenance to positions in project management. By actively promoting gender equality in hiring and training within the renewable energy sector, Western Balkan countries can reduce the unemployment gender gap and empower women economically.

These estimates are based on calculations made by the assessment team. The strongest job creation will occur in solar energy generation, with an expected 18,878 jobs to be created across the WB countries. Until 2030, wind turbine power production in the WB region will generate about 4,500 jobs, and hydropower generation can expect an increase of about 3,700 jobs.

The assessment team's calculations indicate that the total number of direct and indirect new jobs created in the six Western Balkan countries exceeds 55,000. Projections show that solar energy production will account for most of these jobs, generating over 76% (approximately 42,391) of all direct and indirect jobs in the renewable energy sector.

Missing Workforce Skills for Energy Sector Decarbonisation

The assessment team found that growth in the renewable energy sector (RES) will change the demand for jobs, moving away from traditional energy roles toward new positions that require advanced technical and digital skills. Skills such as installing, maintaining, and managing renewable energy technologies and a strong understanding of energy efficiency are becoming increasingly important.

As shown by the assessment team projections and confirmed by the interviewed key informants, workers with skills in the renewable energy sector will be increasingly in demand in the labour

[66] Ruiz Castello, P., Medarac, H., Somers, J. and Mandras, G., Recent trends in coal and peat regions in the Western Balkans and Ukraine, EUR 30837 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41929-7, doi:10.2760/81752, JRC126154.
[67] For summarised information see also BiEPAG (2023).

markets. The demand for solar energy production is expected to rise significantly, and Bosnia and Herzegovina and Serbia will need to address the challenge of educating approximately 10,000 workers. These individuals will require training in the installation and maintenance of solar energy production equipment and in the management of solar energy technologies.

Some professions that will be in demand in solar energy production include solar engineers, solar system designers, solar project managers, solar panel installers, and solar service technicians. A similar range of careers will also be available in wind turbine energy production systems.

According to the KIs, the easiest way to address a skill mismatch between the skills of the available workforce and available jobs is for the companies to provide on-the-job training and upskill their existing staff. However, going further and with the advancement of the energy transition, companies will also need new staff. That is the part where the formal education system should step in.

Data collected reveals that current processes for workforce adjustments in the renewable energy sector are slow in responding to expected demands. Although at the policy levels, there is certain progress in all Western Balkan (WB) countries, real implementation of decarbonization in the energy sector is in the infant phase. Most of the activities implemented so far have focused primarily on raising awareness about the need for energy transition. There has been little concrete action, which has led to a lack of urgency regarding the necessary changes in the education system and workforce upskilling needed to support the energy transition in the Western Balkan countries.

There is minimal concern about the shortage of workers with specific skills in the renewable energy sector. However, there is significant concern regarding the overall lack of a qualified workforce in the labor markets of WB countries.

There are differing opinions about the necessity of establishing specific qualification standards and training programs for workers in the renewable energy sector, such as solar panel assemblers. However, the processes involved in developing qualification standards, educational plans, programs, and their approvals are often time-consuming. They can take up to two years before the first student is enrolled.

Some interviewed professionals stated that they are currently developing curricula for various professions in the renewable energy sector. These include renewable energy engineers, maintenance and installation technicians, energy analysts, and sustainable development consultants. They also emphasise the need to address workforce development in the energy efficiency sector and occupations related to digitalisation. This is especially important since companies must undergo both processes.

Some interviewed stakeholders believe that existing qualifications, like those of an electrical or energy system technician, are sufficient, provided these technicians receive some short additional training. For example, the energy sector technicians would need to upgrade their skills to keep up with evolving technologies and work environments. This entails overcoming challenges related to installing, commissioning, and maintaining renewable energy structures and equipment. The working conditions demand strict compliance with health and safety regulations and protocols, as technicians may need to lift heavy equipment, work in remote locations, operate at heights and endure extreme weather conditions. Also, In the future, renewable energy technicians, who currently need experience and skills in one or two specific forms of renewable energy, will need

to expand their roles. They must focus on developing renewable technology and addressing the increasing supply and demand for these energy sources.

According to interviews with grid operators, these companies are not perceived as attractive employers, particularly for high-quality engineering experts. As a result, they need to invest significantly more effort in improving job quality to retain their current workforce and attract the new talent necessary to meet the challenges posed by the energy transition. According to KIs, grid operators must develop their capacities and internal competencies to face challenges and act as agents of change in the energy systems of the WB countries.

The key challenges and opportunities for matching the supply of energy sector professionals with the evolving demand in renewable energy and energy efficiency sectors.

All countries' labour markets face worker shortages and a lack of qualified individuals in the renewable energy and energy efficiency sectors. Key issues include low labour market participation rates, particularly in certain Western Balkan countries like Bosnia and Herzegovina, and a mismatch between the skills and knowledge of the available workforce and the requirements of jobs. Also, the interviewed key informants (KIs) argue that the education system fails to prepare students for the workforce, leading to a mismatch between the skills of workers and the available jobs. Despite efforts to address the issue by implementing a dual education system, interest remains low in large-scale adoption, even though formal preconditions exist.

To address these labour shortages, it is essential to increase market participation among youth—especially those not in education, employment, or training (NEET)—women, older workers, discouraged workers, and individuals in the informal sector. Enhancing their attachment to the labour market will require a combination of incentives for companies, support for these vulnerable groups, and robust retraining and upskilling opportunities.

In the long run, adjustments in the formal education system—particularly in VET and tertiary education—should align with evolving demand. It is the responsibility of the Ministries of Education, along with other educational institutions, the private sector, and various stakeholders, to engage in discussions and reach agreements on developing new qualifications. Additionally, they should explore how to implement open curricula and integrate the green agenda and renewable energy throughout the education system. However, to meet energy transition objectives by 2030, a high-capacity and flexible adult education system will be necessary.

R1: Topics such as renewable energy sources, energy efficiency, decarbonization, and green economy are cross-cutting themes that should be horizontally integrated into the formal education system at almost every educational level and across various professions and occupations.

To achieve that, a permanent working group of representatives from the Ministry of Education, the Ministry of Energy, the Chamber of Commerce, VET institutions, adult training institutions, and other stakeholders will be necessary to expedite information exchange and embed these topics into the education system. Cross-sector cooperation should enhance the alignment of various strategies aimed at developing systematic solutions. It should facilitate the identification of skills gaps, promote adequate training, and address the technical, economic, and societal challenges that hinder the decarbonization of the power sector.

More specifically development of systemic solutions would require:

- Preparing an analytical basis that includes assessment of financing/investment opportunities, qualitative and quantitative impact assessments of the investments in infrastructure, education, institutional capacity development, and business-environment , on the labour market
- Support the preparation of business decarbonisation strategies, including investment plans and social plans
- Identify the necessary future skills of workers and refer them to education, upskilling and retraining
- The development of training and educational programs aligned with the needs of the labour market
- Informing workers about the need to engage in lifelong learning programs and strengthen competencies for decarbonisation

R2: International organizations should consider supporting educational institutions by providing expert and technical assistance to build their capabilities to develop a methodology for creating vocational education standards. One area of assistance, especially in the higher education segment, is the provision of technical assistance that will increase institutions' and higher education capacities. integrate skills and knowledge in their programs.

R3: Consider advocating with governments to support companies and vocational schools in developing apprenticeships in the renewable energy sector, progressively increasing the share and quality of work-related learning, and developing methods of combining work-based learning with school-based education. This should be part of the overall VET policy that makes on-the-job training a requirement.

Adult education and lifelong learning are crucial areas for development in the Western Balkans as these countries prepare for EU integration and economic modernization. While progress has been made, significant challenges remain in participation, digital access, and policy coherence. The region's efforts are supported by international collaborations and national reforms, aiming to create inclusive and flexible learning systems.

R4: Countries such as Bosnia and Herzegovina, Albania, and Kosovo should consider designing specific policies to improve the adult education system and align them with EU strategies, such as the European Education Area and Agenda for Adult Learning. That should represent a step forward in adjusting national education systems to international standards. All countries could benefit from further improving the National Qualifications Frameworks (NQF) and formal, non-formal, and informal learning accreditation systems.

R5: Governments should consider allocating more resources to adult learning infrastructure and programs. Public-private partnerships can also provide additional resources for expanding adult education initiatives, particularly in high-demand sectors like IT systems related to energy systems management and renewable energy production.

R6: Governments in the Western Balkans should take a more proactive approach to access opportunities offered by EU programs such as Erasmus+ and the Instrument for Pre-Accession Assistance (IPA). This support can help finance capacity-building in adult education institutions, provide teacher training, and develop new programs.

R7: Increase participation rates in adult training programs, focusing on education related to professions and vocations in the renewable energy sector. Adult education programs and vocational training initiatives are central to resolving the absence of a qualified workforce needed to facilitate processes related to the energy transition in the WB region. To increase currently low participation rates, increasing awareness about the importance of lifelong learning through national campaigns can help shift public perceptions. This is important in cultures where lifelong learning is not yet embedded. Campaigns should highlight continued education's personal, social, and economic benefits.

R8: Information campaigns promoting lifelong learning, adult education, and subsidized or free education programs in the renewable energy sector should target underserved populations, such as coal-based regions, individuals in danger of losing jobs, low-income individuals, unemployed individuals, low-skilled workers, economically inactive persons, older adults, and women. Offering free or subsidized courses can significantly improve participation rates. Customized outreach programs that address their specific barriers, such as time constraints, financial limitations, and access to information, are essential.

R9: Consider improving vocational education and training programs related to the renewable energy sector to provide and expand flexible and accessible learning pathways to meet labor market demands. Many adults, particularly those with work and family obligations, need flexible learning options. Offering part-time, evening, and weekend classes and modular learning formats can make participation easier.

R10: Consider supporting further development of vocational training programs to equip adults with industry-relevant skills to advance solar and wind energy production.

R11: To create and expand flexible learning options for adults, support the further development of Digital Learning and E-Learning Platforms will be necessary. Developing accessible, user-friendly online education platforms is vital for improving participation. Governments should invest in ICT infrastructure, especially in rural areas and coal-based regions, to broaden the access to digital education.

R12: Consider expanding the network of training centers to directly reach more communities and improve adult learning accessibility throughout the countries. The Serbia Chamber of Commerce’s Education Center could utilize its network of regional offices to enhance training and education opportunities in regions with limited adult education resources. This could be particularly beneficial for coal regions facing potential job losses. Establishing lifelong learning centres in these coal-based local communities, where adults can access in-person learning opportunities, is crucial. These centers could provide vocational training, digital literacy programs, language courses, and soft skills training.

R13: Government and international organizations should consider supporting non-formal education, such as online learning and community-based programs related to renewable energy sources. The non-formal education system should also be used as an extinguisher when there is an urgent need for certain professions in this sector. Micro-credentials and short courses can provide quicker pathways to new skills without requiring extensive time commitment

R14: The government should consider providing **financial support to companies facing challenges in finding a qualified workforce in the renewable energy sector.** These funds should reduce companies' financial burden when investing in employees' continuous education,

education through internship schemes or on-the-job training to upgrade skills and address skills mismatch issues due to the absence of a qualified workforce.

List of figures

8 List of tables

9 Abbreviations

BiH	**Bosnia and Herzegovina**
DSO	Distribution system operator
EC	European Commission
EF	Employment factor
ENTSOE	European Network of Transmission System Operators for Electricity
EU	European Union
FDI	Foreign Direct Investments
GAWB	Green Agenda for the Western Balkans
GWEC	
ILO	International Labour Organization
IRENA	International Renewable Energy Agency
MW	Mega Watt
NEET	Not in education, employment or training
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
RE	Renewable energy
RES	Renewable energy sources
RQ	Research Question
STEM	Science, technology, engineering, and mathematics
TPP	Thermal Power Plant
TSO	Transmission system operator
VET	Vocational education and training
WB	Western Balkans

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